AD-A031 936 AIRESEARCH MFG CO OF ARIZONA PHOENIX F/G 20/4

ENVIRONMENTAL TEST PROGRAM FOR EVALUATION OF FLUIDIC ELEMENTS F--ETC(U)

DEC 75 M F CYCON, T G SUTTON, H R GAMBLE DAAG39-74-C-0187

UNCLASSIFIED 75-411145 HDL-CR-75-187-1 NL

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# ENVIRONMENTAL TEST PROGRAM — FLUIDIC ELEMENTS

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Prepared by

AiResearch Manufacturing Company of Arizona
A Division of The Garrett Corporation
Phoenix, Arizona

December 12, 1975

Under Contract

DAAG39-74-C-0187

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U.S. Army Materiel Command
HARRY DIAMOND LABORATORIES
Adelphi, Maryland 20783

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# HDL-CR-75-187-1

HDL-CR-187-1, Environmental Test Program for Evaluation of Fluidic Elements, Mike F. Cycon, Jr., Treavor G. Sutton, Harry R. Gamble

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Fluidic elements, environmental test, environmental sensitivity, performance characteristics.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This is the final report on the program to test proportional laminar fluidic amplifiers and circuits under environments of temperature and vibration. The amplifiers were operated on both air and hydraulic oil (MIL-H-5606). The temperature range was 25C (77F) to 135C (275F) for air tests and 16C (60.8F) to 57C (134.6F) for hydraulic tests. Performance characteristics monitored for the different temperatures were pressure gain,

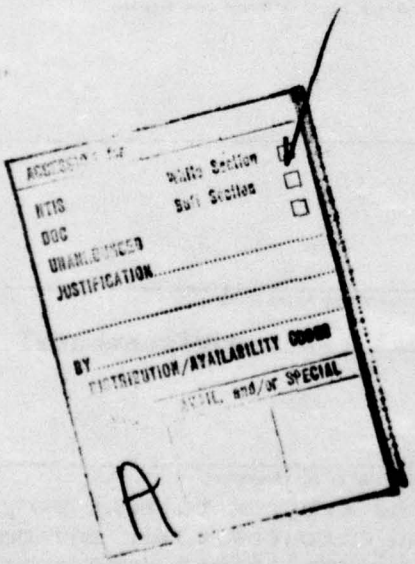
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20. common mode rejection, input impedance, output impedance, and power jet impedance. Where applicable, air tests were performed at both constant power jet Reynolds numbers and constant supply pressure. Hydraulic tests were made at constant power jet Reynolds numbers. Pressure gain in a vibration environment was monitored for air operation only.



## FOREWORD

This is the final report on a program conducted by AiResearch Manufacturing Company of Arizona, a Division of The Garrett Corporation, for the Department of the Army, Harry Diamond Laboratories to compile data on specific fluidic elements operating with both air and hydraulic oil under various environmental conditions.

This research program was authorized by Harry Diamond Laboratories Contract DAAG39-74-C-0187 and was conducted during the period from August 1, 1974, to August 22, 1975, under AiResearch Master Work Order 3209-214361-01-0100. F. Manion and T. Drzewiecki, 310, provided technical direction and administered the program for Harry Diamond Laboratories.

Publication of this report does not constitute U.S. Army or Harry Diamond Laboratories approval of the findings presented herein.

TABLE OF CONTENTS


| SECTION | | PAGE |
|---|---|---|
| | REPORT DOCUMENTATION PAGE | 1 AND 2 |
| | FOREWORD | 3 |
| 1 | INTRODUCTION AND OBJECTIVES | 9 |
| | 1.1 INTRODUCTION | 9 |
| | 1.2 TECHNICAL OBJECTIVES | 9 |
| | 1.3 TEST COMPONENTS | 9 |
| | 1.4 TEST CONDITIONS AND INSTRUMENTATION | 14 |
| 2 | TEST PLAN AND PROCEDURES | 23 |
| | 2.1 TEST PLAN | 23 |
| | 2.2 TEST PROCEDURES | 28 |
| | 2.2.1 AIR TESTS | 28 |
| | 2.2.2 HYDRAULIC TESTS | 49 |
| 3 | TEST RESULTS | 55 |
| | 3.1 AIR TEST RESULTS | 55 |
| | 3.2 HYDRAULIC TEST RESULTS | 65 |
| APPENDIX A | AIR TEST DATA | |
| APPENDIX B | HYDRAULIC TEST DATA | |

LIST OF TABLES


| TABLE | DESCRIPTION | PAGE |
|---|---|---|
| I | DIMENSIONAL INSPECTION OF SECOND SET OF PARTS | 13 |
| II | THREE-STAGE AMPLIFIER ASSEMBLIES | 15 |
| III | SUPPLY PRESSURE | 19 |
| IV | TEST INSTRUMENTATION | 21 |
| V | TEST SCHEDULE, AIR TESTS | 24 |
| VI | TEST SCHEDULE, HYDRAULIC TESTS | 25 |
| VII | TEST RESULTS, SINGLE-STAGE AMPLIFIER GAIN WITH $N_R$ CONSTANT | 56 |
| VIII | TEST RESULTS, THREE-STAGE AMPLIFIER GAIN WITH $N_R$ CONSTANT | 57 |
| IX | TEST RESULTS, SINGLE-STAGE AMPLIFIER GAIN WITH $P_S$ CONSTANT | 58 |
| X | TEST RESULTS, THREE-STAGE AMPLIFIER GAIN WITH $P_S$ CONSTANT | 59 |
| XI | VIBRATION GAIN TEST RESULTS | 60 |
| XII | SUMMARY OF COMMON MODE REJECTION RATIO, SINGLE-STAGE AMPLIFIER | 61 |
| XIII | SUMMARY OF COMMON MODE REJECTION RATIO, THREE-STAGE AMPLIFIER | 62 |
| XIV | TEST RESULTS, SINGLE-STAGE AMPLIFIER GAIN | 66 |
| XV | TEST RESULTS, THREE-STAGE AMPLIFIER GAIN | 67 |
| XVI | SUMMARY OF COMMON MODE REJECTION RATIO, SINGLE-STAGE AMPLIFIER | 68 |
| XVII | SUMMARY OF COMMON MODE REJECTION RATIO, THREE-STAGE AMPLIFIER | 69 |

## LIST OF FIGURES


| FIGURE | DESCRIPTION | PAGE |
|---|---|---|
| 1 | TEST LAMINATES | 10 |
| 2 | DRAWING PA3152154 | 11 |
| 3 | DRAWING PA3152156 | 12 |
| 4 | STACKING ORDER, THREE-STAGE AMPLIFIER NO. 1 | 16 |
| 5 | STACKING ORDER, THREE-STAGE AMPLIFIER NO. 2 | 17 |
| 6 | STACKING ORDER, THREE-STAGE AMPLIFIER NO. 3 | 18 |
| 7 | TURBINE METER CALIBRATION FM 275 | 22 |
| 8 | AIR TEST SETUP IN AMBIENT BOX | 26 |
| 9 | HYDRAULIC TEST SETUP | 27 |
| 10 | TEST SETUP, SINGLE-STAGE PRESSURE GAIN | 29 |
| 11 | TEST SETUP, THREE-STAGE PRESSURE GAIN | 30 |
| 12, 13, AND 14 | VIBRATION TEST, THREE-STAGE FLUIDIC AMPLIFIER | 33, 34, AND 35 |
| 15 | TEST SETUP, SINGLE-STAGE, COMMON MODE REJECTION | 37 |
| 16 | TEST SETUP, THREE-STAGE COMMON MODE REJECTION | 38 |
| 17 | TEST SETUP, INPUT IMPEDANCE, CENTERED JET | 40 |
| 18 | TEST SETUP, INPUT IMPEDANCE, DEFLECTED JET | 43 |
| 19 | TEST SETUP, SINGLE-STAGE, OUTPUT IMPEDANCE | 45 |
| 20 | TEST SETUP, THREE-STAGE, OUTPUT IMPEDANCE | 46 |

LIST OF FIGURES (CONCLUDED)


| FIGURE | DESCRIPTION | PAGE |
|---|---|---|
| 21 | TEST SETUP, POWER JET IMPEDANCE | 48 |
| 22 | TEST SETUP, INPUT IMPEDANCE, CENTERED JET, HYDRAULIC | 51 |
| 23 THRU 32 | GAIN VS CONTROL PRESSURE LEVEL | 71 THRU 80 |
| 33 AND 34 | GAIN VS TEMPERATURE | 81 AND 82 |
| 35 THRU 40 | GAIN VS CONTROL PRESSURE LEVEL | 83 THRU 88 |
| 41 THRU 48 | INPUT IMPEDANCE (CENTERED JET) VS TEMPERATURE | 89 THRU 96 |
| 49 THRU 54 | INPUT DEFLECTION IMPEDANCE VS TEMPERATURE | 97 THRU 102 |
| 55 THRU 58 | OUTPUT IMPEDANCE VS TEMPERATURE | 103 THRU 106 |
| 59 AND 60 | POWER JET IMPEDANCE VS TEMPERATURE | 107 AND 108 |
| 61 THRU 70 | GAIN VS CONTROL PRESSURE LEVEL | 109 THRU 118 |
| 71 THRU 82 | CONTROL FLOW VS CONTROL PRESSURE | 119 THRU 130 |
| 83 AND 84 | INPUT IMPEDANCE (CENTERED JET) VS TEMPERATURE | 131 AND 132 |
| 85 THRU 108 | CONTROL FLOW VS CONTROL PRESSURE | 133 THRU 156 |
| 109 AND 110 | INPUT IMPEDANCE (DEFLECTED JET) VS TEMPERATURE | 157 AND 158 |
| 111 THRU 122 | OUTPUT FLOW VS OUTPUT PRESSURE | 159 THRU 170 |
| 123 AND 124 | OUTPUT IMPEDANCE VS TEMPERATURE | 171 AND 172 |
| 125 AND 126 | SUPPLY FLOW VS PRESSURE | 173 AND 174 |
| 127 | POWER JET IMPEDANCE VS TEMPERATURE | 175 |

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# SECTION 1

# INTRODUCTION AND OBJECTIVES

## 1.1 INTRODUCTION

This is the final report on the program conducted by AiResearch Manufacturing Company of Arizona, a Division of The Garrett Corporation, for the Harry Diamond Laboratories, Department of the Army, to compile data on the performance characteristics and the sensitivity of two specific fluidic element designs while operating with both air and hydraulic oil under various environmental conditions.

The research program was authorized by Harry Diamond Laboratories Contract DAAG39-74-C-0187 and was conducted under the technical direction of F. Manion and T. Drzewiecki of HDL during the period from August 1, 1974, to August 22, 1975. This report is in partial fulfillment of Item 0001AA (Data Requirements) of the contract; the CDRL item covered herein is identified as Sequence 002 (Final Report).

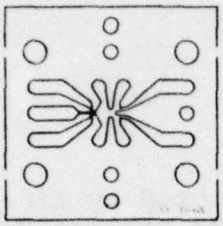
## 1.2 TECHNICAL OBJECTIVES

This research program was directed at compiling a comprehensive set of data so that the contracting agency may use it in a program that will ultimately evaluate the sensitivity of proportional laminar fluidic amplifiers and circuits to adverse temperature and vibration environments. Two early research components and three circuits, made up of these components, were operated with both air and hydraulic oil (MIL-H-5606B) at various test conditions. Performance and characteristic parameters measured were pressure gain, input impedance, output impedance, power jet impedance, and common mode rejection ratio.

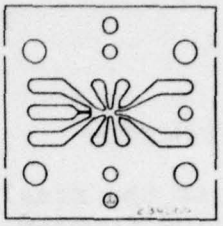
## 1.3 TEST COMPONENTS

Five fluidic components, two basic single-stage amplifiers and three multistage amplifier configurations, were manufactured for the test program. The amplifier configurations were based on two designs provided by HDL, identified as HDL designs 2.3.1.004A and 2.3.4.004. These two amplifiers and their associated AiResearch part numbers are shown in Figure 1.

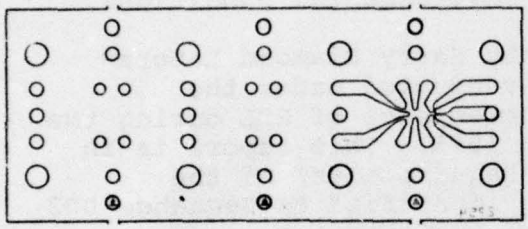
The individual laminations were made by photochemical milling of stainless steel sheets. The parts were inspected for dimensional accuracy using an optical comparator at magnifications of ten and one hundred. Critical dimensions, as specified on Drawings PA3152154 and PA3152156 (Figures 2 and 3, respectively), were measured on the comparator which has an accuracy of ±0.025 mm (±0.0001 inch). The results of this inspection are summarized in Table I.



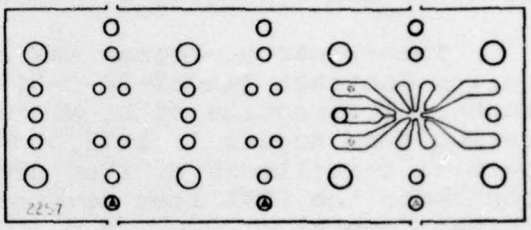
HDL AMPLIFIER
2.3.1.004A



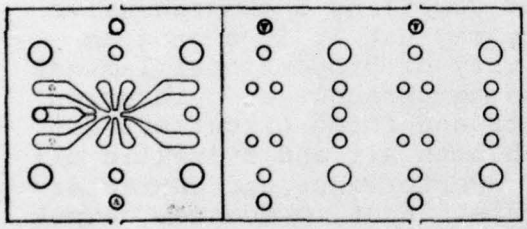
HDL AMPLIFIER
2.3.4.004



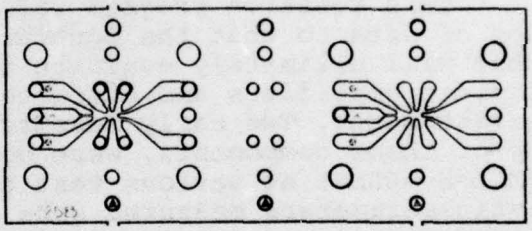
AIRESEARCH PART 3152254
STAGE 1, THREE-STAGE
AMPLIFIER NO. 3



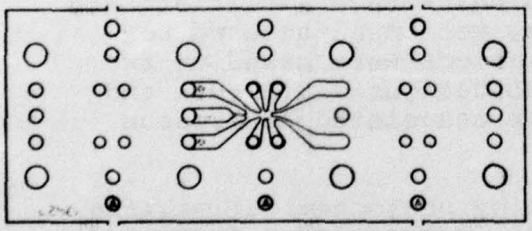
AIRESEARCH PART 3152257
STAGE 3, THREE-STAGE
AMPLIFIER NO. 1 AND 3



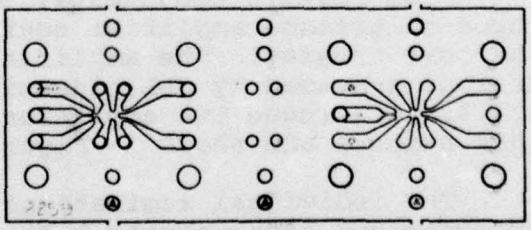
AIRESEARCH PART 3152255 (MODIFIED)
STAGE 1, THREE-STAGE
AMPLIFIER NO. 1 AND 2



AIRESEARCH PART 3152258
STAGE 1 AND 3, THREE-STAGE
AMPLIFIER NO. 1 AND 2



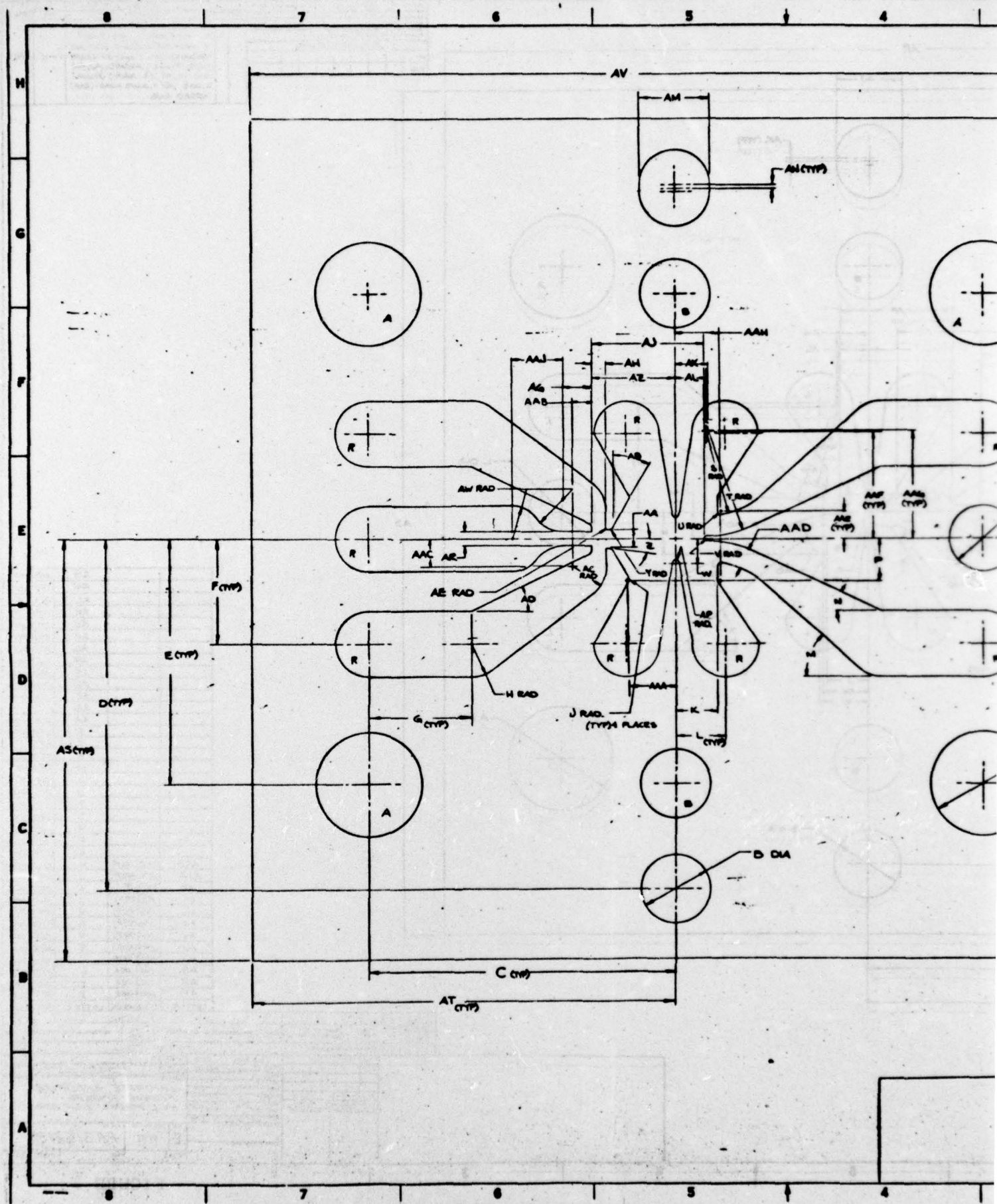
AIRESEARCH PART 3152256
STAGE 2, THREE-STAGE
AMPLIFIERS NO. 1, 2, AND 3

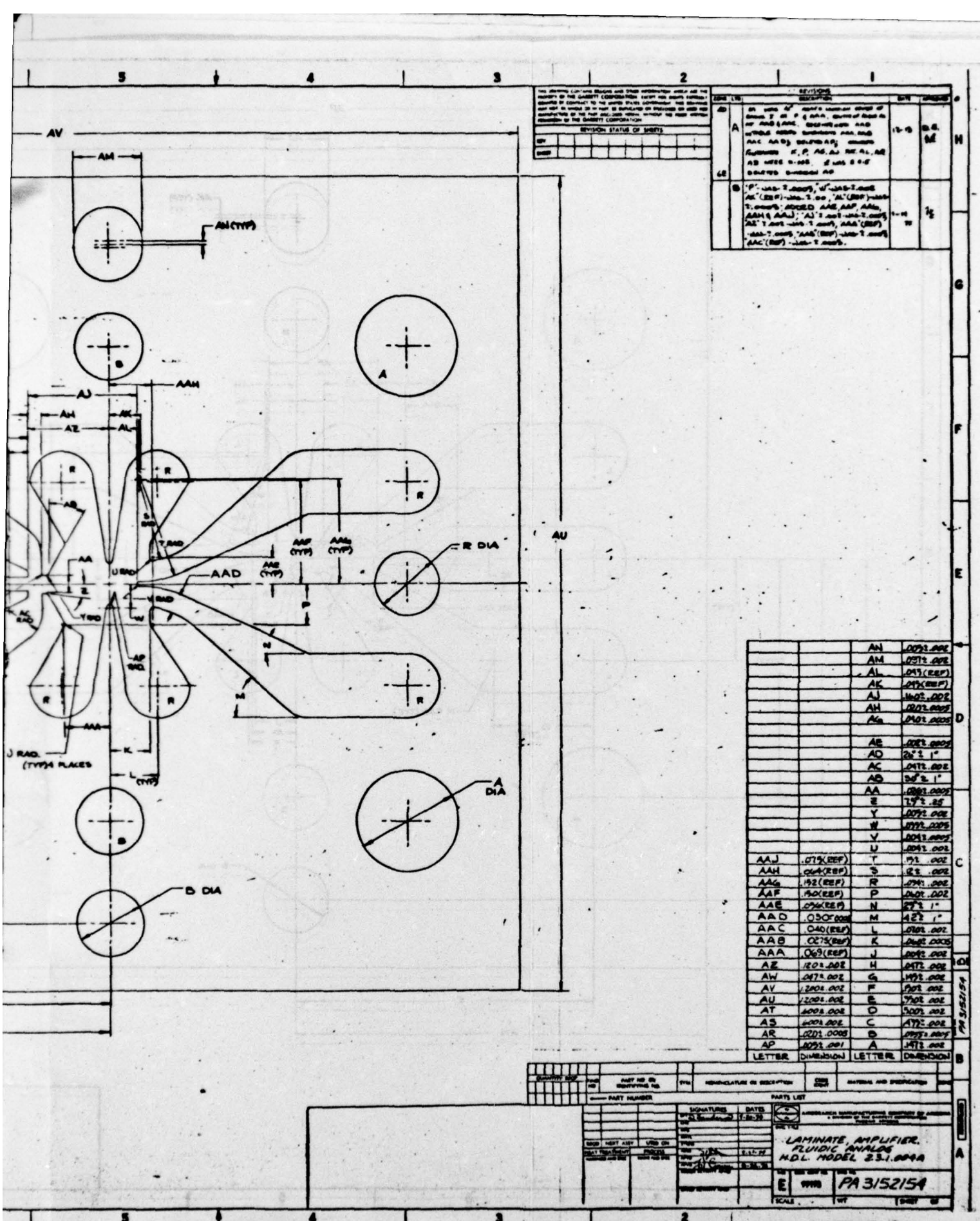


AIRESEARCH PART 3152259
STAGE 1 AND 3, THREE-STAGE
AMPLIFIER NO. 3

FIGURE 1

TEST LAMINATES


AV
AM
AN (TYP)
AJ
AAH
AAJ
AH
AK
AZ
AL
AG
AAB
AW RAD
AA
U RAD
AAD
AAF (TYP)
AAG (TYP)
AAE (TYP)
AAC
AR
AC RAD
AE RAD
AD
AP RAD
F (TYP)
E (TYP)
D (TYP)
AS (TYP)
H RAD
G (TYP)
AAA
J RAD. (TYP) 4 PLACES
K
L (TYP)
B DIA
C (TYP)
AT (TYP)
A
B
R

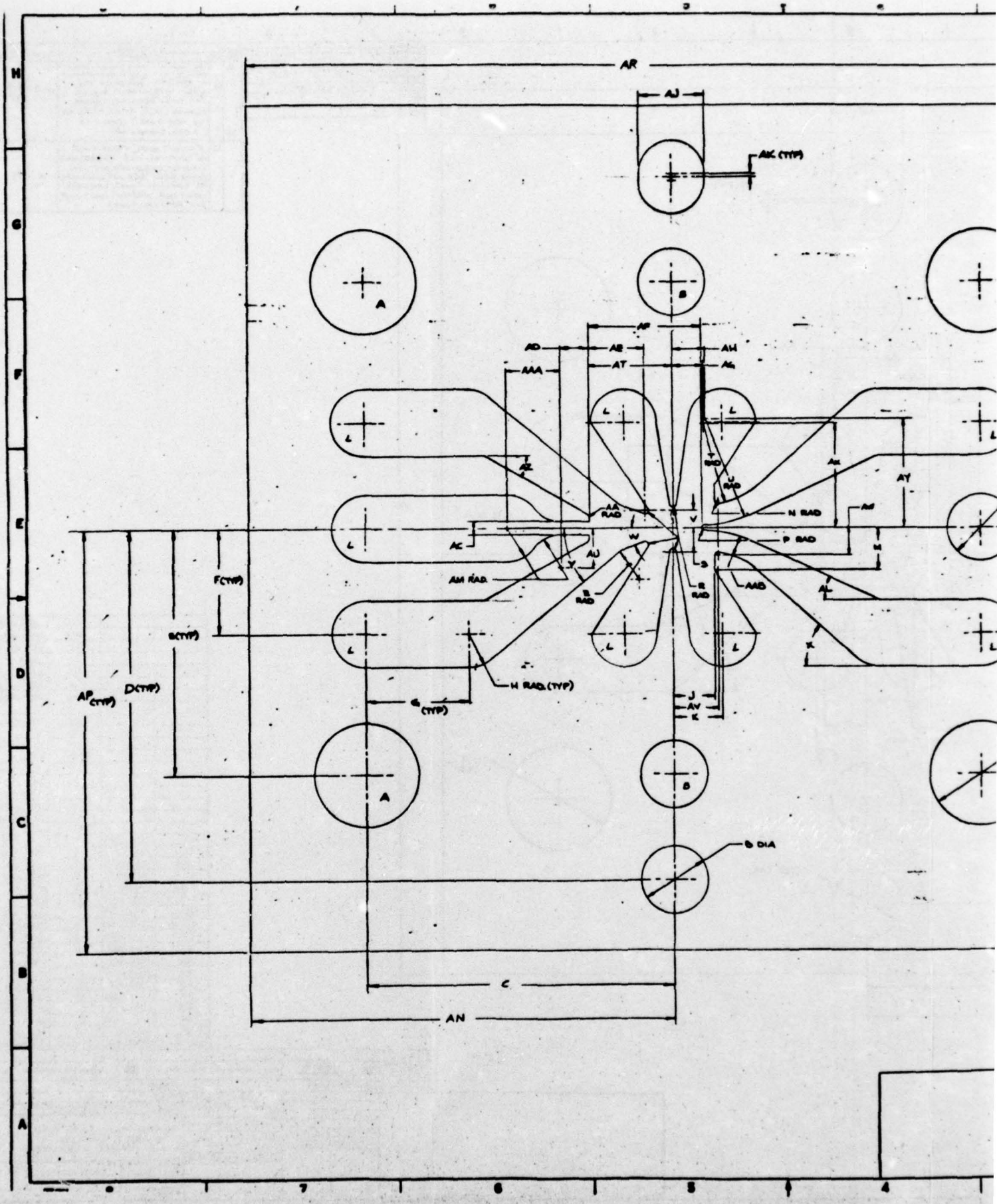


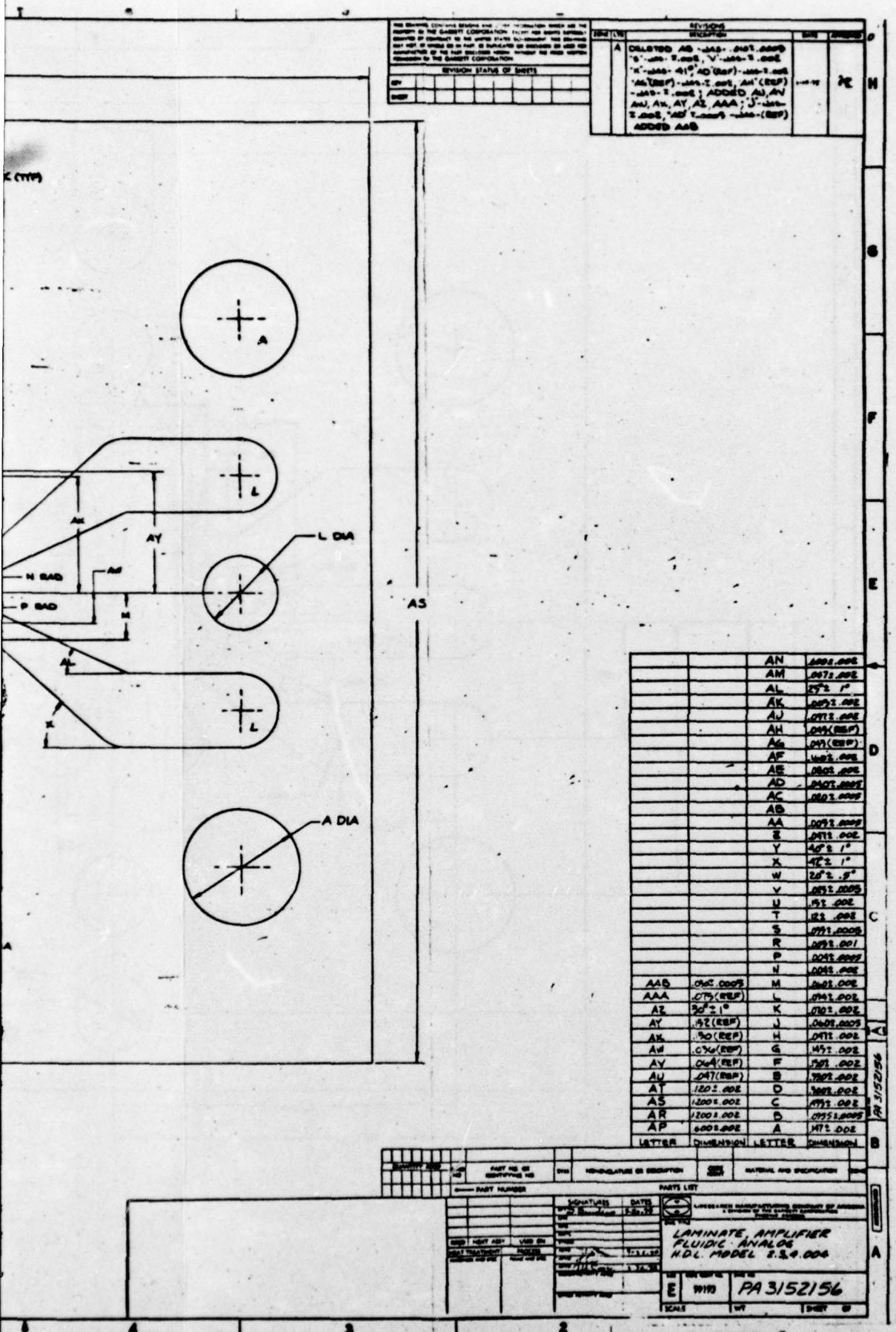

| | | | |
|---|---|---|---|
| | | AN | .0093.0005 |
| | | AM | .0372.002 |
| | | AL | .093(REF) |
| | | AK | .093(REF) |
| | | AJ | .1402.002 |
| | | AH | .1207.0005 |
| | | AG | .0402.0005 |
| | | AE | .0082.0005 |
| | | AD | 26°2 1° |
| | | AC | .0472.002 |
| | | AB | 30°2 1° |
| | | AA | .0803.0005 |
| | | Z | 75°2.25 |
| | | Y | .0092.002 |
| | | W | .0772.0005 |
| | | V | .0043.0005 |
| | | U | .0042.002 |
| AAJ | .079(REF) | T | .192 .002 |
| AAH | .064(REF) | S | .82 .002 |
| AAG | .152(REF) | R | .0791.002 |
| AAF | .150(REF) | P | .0401.002 |
| AAE | .094(REF) | N | 27°2 1° |
| AAD | .030°.005 | M | 42°2 1° |
| AAC | .040(REF) | L | .0702.002 |
| AAB | .0275(REF) | K | .0402.0005 |
| AAA | .069(REF) | J | .0092.002 |
| AZ | .120±.002 | H | .0472.002 |
| AW | .0472.002 | G | .1492.002 |
| AV | .1202.002 | F | .502.002 |
| AU | .1202.002 | E | .7502.002 |
| AT | .600±.002 | D | .5002.002 |
| AS | .600±.002 | C | .472.002 |
| AR | .0201.0005 | B | .0972.0005 |
| AP | .0052.001 | A | .1472.002 |
| LETTER | DIMENSION | LETTER | DIMENSION |

| | | | |
|---|---|---|---|
| | | AN | .0093.0005 |
| | | AM | .0372.002 |
| | | AL | .093(REF) |
| | | AK | .093(REF) |
| | | AJ | .1402.002 |
| | | AH | .1207.0005 |
| | | AG | .0402.0005 |
| | | AE | .0082.0005 |
| | | AD | 26°2 1° |
| | | AC | .0472.002 |
| | | AB | 30°2 1° |
| | | AA | .0803.0005 |
| | | Z | 75°2.25 |
| | | Y | .0092.002 |
| | | W | .0772.0005 |
| | | V | .0043.0005 |
| | | U | .0042.002 |
| AAJ | .079(REF) | T | .192 .002 |
| AAH | .064(REF) | S | .82 .002 |
| AAG | .152(REF) | R | .0791.002 |
| AAF | .150(REF) | P | .0401.002 |
| AAE | .094(REF) | N | 27°2 1° |
| AAD | .030°.005 | M | 42°2 1° |
| AAC | .040(REF) | L | .0702.002 |
| AAB | .0275(REF) | K | .0402.0005 |
| AAA | .069(REF) | J | .0092.002 |
| AZ | .120±.002 | H | .0472.002 |
| AW | .0472.002 | G | .1492.002 |
| AV | .1202.002 | F | .502.002 |
| AU | .1202.002 | E | .7502.002 |
| AT | .600±.002 | D | .5002.002 |
| AS | .600±.002 | C | .472.002 |
| AR | .0201.0005 | B | .0972.0005 |
| AP | .0052.001 | A | .1472.002 |
| LETTER | DIMENSION | LETTER | DIMENSION |



FIGURE 2


AR
AJ
AK (TYP)
A
B
AP
AD
AE
AH
AAA
AT
AG
AZ
AK
AY
T RAD
U RAD
AA RAD
N RAD
V
AM
W
P RAD
AC
AJ
Y
M
AM RAD
B RAD
R RAD
AAB
AL
K
F(TYP)
E(TYP)
D(TYP)
AP(TYP)
H RAD (TYP)
G (TYP)
J
AV
K
A
B
S DIA
C
AN




| LETTER | DIMENSION | LETTER | DIMENSION |
|---|---|---|---|
| AAB | .046" .0005 | M | .4402.002 |
| AAA | .075 (REF) | L | .0942.002 |
| AZ | 30°±1° | K | .0702.002 |
| AY | .42 (REF) | J | .0609.0005 |
| AX | .30 (REF) | H | .0472.002 |
| AW | .036 (REF) | G | .1452.002 |
| AV | .044 (REF) | F | .2502.002 |
| AU | .047 (REF) | E | .3902.002 |
| AT | .120±.002 | D | .3602.002 |
| AS | 1.200±.002 | C | .4992.002 |
| AR | 1.200±.002 | B | .0955±.0005 |
| AP | 6.002.002 | A | .1472.002 |
| AN | .4004.002 | | |
| AM | .0672.002 | | |
| AL | 25°± 1° | | |
| AK | .0592.002 | | |
| AJ | .0772.002 | | |
| AH | .044 (REF) | | |
| AG | .047 (REF) | | |
| AF | .1402.002 | | |
| AE | .0802.002 | | |
| AD | .0402.0005 | | |
| AC | .0802.0005 | | |
| AB | | | |
| AA | .0092.0005 | | |
| Z | .0772.002 | | |
| Y | 45°± 1° | | |
| X | 25°± 1° | | |
| W | 28°± .5° | | |
| V | .0852.0005 | | |
| U | .152.002 | | |
| T | .122.002 | | |
| S | .0772.0005 | | |
| R | .0092.001 | | |
| P | .0092.0005 | | |
| N | .0092.002 | | |

FIGURE 3



2

TABLE I

DIMENSIONAL INSPECTION OF SECOND SET OF PARTS

| H.D.L. Mode. 2.3.1.004A AiResearch Part 3152224 | | | | |
|---|---|---|---|---|
| | Required | | | |
| Dimension* | High | Low | Actual | Error |
| V | 0.0045 | 0.0035 | 0.004 | - |
| W | 0.037 | 0.033 | 0.03415 | - |
| AA | 0.0265 | 0.0255 | 0.0260 | - |
| AF | 0.0105 | 0.0095 | 0.010 | - |
| AG | 0.042 | 0.038 | 0.040 | - |
| AH | 0.0205 | 0.0195 | 0.0198 | - |
| AJ | 0.162 | 0.158 | 0.1606 | - |
| AK | 0.047 | 0.043 | 0.045 | - |
| AP | 0.006 | 0.004 | 0.005 | - |
| AR | 0.0205 | 0.0195 | 0.0202 | - |
| AW | 0.049 | 0.045 | 0.047 | - |

* Refer to Figure 2

| H.D.L. Model 2.3.4.004 AiResearch Part 3152225 | | | | |
|---|---|---|---|---|
| | Required | | | |
| Dimension** | High | Low | Actual | Error |
| P | 0.0045 | 0.0035 | 0.0039 | - |
| R | 0.006 | 0.004 | 0.005 | - |
| S | 0.037 | 0.033 | 0.0333 | - |
| V | 0.027 | 0.023 | 0.0254 | - |
| AB | 0.0105 | 0.0095 | 0.0098 | - |
| AC | 0.0205 | 0.0195 | 0.0201 | - |
| AD | 0.042 | 0.038 | 0.040 | - |
| AE | 0.082 | 0.078 | 0.0804 | - |
| AF | 0.162 | 0.158 | 0.1601 | - |
| AM | 0.049 | 0.045 | 0.047 | - |

** Refer to Figure 3

NOTE: All dimensions are in inches

The single-stage amplifier configuration was a bonded assembly consisting of two amplifier laminations. Bonding was accomplished in a quartz lamp furnace in an inert atmosphere.[1] The exception to this was for measurement of amplifier impedances with hydraulic oil where it was necessary to stack several stages in parallel to boost the flow rates because of limitations of the flowmeter's low-range capability. Bonded assemblies were not used for these tests.

The multistage amplifier assembly consisted of a bonded, three-stage amplifier. Three configurations, with different amplifier designs and load conditions, were assembled. The stacking arrangements of these three assemblies are listed in Table II and are illustrated in Figures 4, 5, and 6.

## 1.4 TEST CONDITIONS AND INSTRUMENTATION

The performance of laminar fluidic amplifiers is directly related to the power jet Reynolds number which varies with the supply pressure, viscosity, and density of the operating fluid for a given amplifier geometry. Both viscosity and density are temperature dependent parameters; therefore, it was necessary to adjust the supply pressure with operating temperature to maintain constant Reynolds number. Two values of Reynolds number, 85 and 42.5, were chosen as a test condition.[2] This Reynolds number is a modified or stretched Reynolds number using a characteristic dimension which is a complex function of the amplifier power jet geometry. Table III lists the supply pressure required for each test temperature to maintain the Reynolds number constant, due to the different fluid viscosity and density.

In order to obtain some data at Reynolds numbers other than those specified above, tests were also made for air operation at different temperatures for the condition of constant supply pressure. The supply pressures chosen corresponded to Reynolds numbers of 85 and 42.5 at a temperature of 353K. Amplifier characteristics measured for these test conditions were pressure gain, input impedance, and output impedance.

[1] Sutton, T. G., Anderson, W. J., "*Aerospace Fluidics Applications and Circuit Manufacture*", Proceedings HDL Fluidic State-of-the-Art Symposium, V.5, Adelphi, Md., Oct. 1974

[2] Drzewiecki, T. M., "*A Fluid Amplifier Reynolds Number*", Proc. HDL Fluidic State-of-the-Art Symposium, V.2, Adelphi, Md., Oct. 1974 (AD 787547)

TABLE II

THREE-STAGE AMPLIFIER ASSEMBLIES

| | Amp Assembly No. 1 | | | Amp Assembly No. 2 | | | Amp Assembly No. 3 | | |
|---|---|---|---|---|---|---|---|---|---|
| | HDL Part Number | No. of Parallel Stages | LAM/ Stage | HDL Part Number | No. of Parallel Stages | LAM/ Stage | HDL Part Number | No. of Parallel Stages | LAM/ Stage |
| 1st Stage | 2.3.4.004 | 1 | 8 | 2.3.4.004 | 1 | 8 | 2.3.1.004A | 1 | 8 |
| 2nd Stage | 2.3.4.004 | 2 | 4 | 2.3.4.004 | 1 | 4 | 2.3.4.004 | 2 | 4 |
| 3rd Stage | 2.3.4.004 | 4 | 2 | 2.3.4.004 | 1 | 2 | 2.3.4.004 | 4 | 2 |

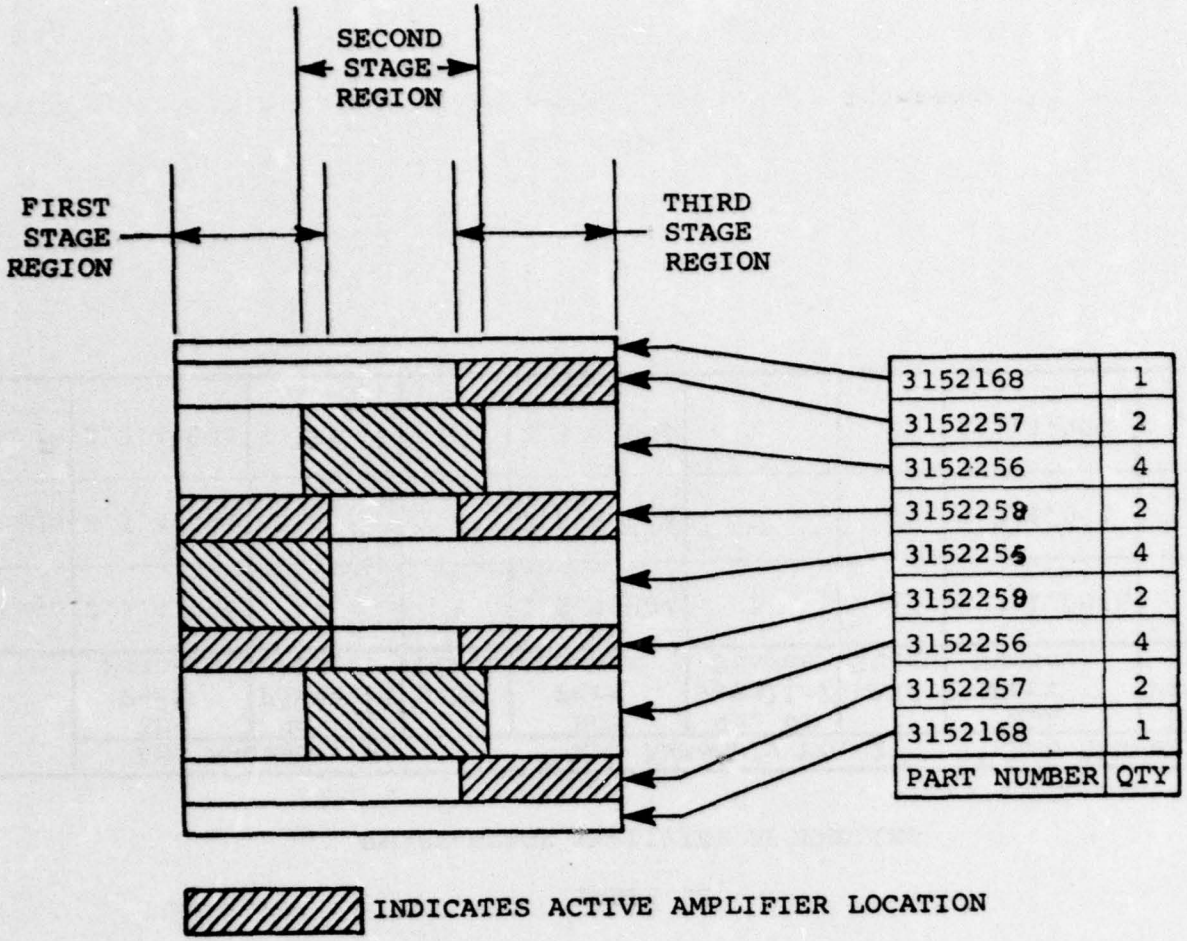



FIGURE 4

STACKING ORDER
THREE-STAGE AMPLIFIER NO. 1

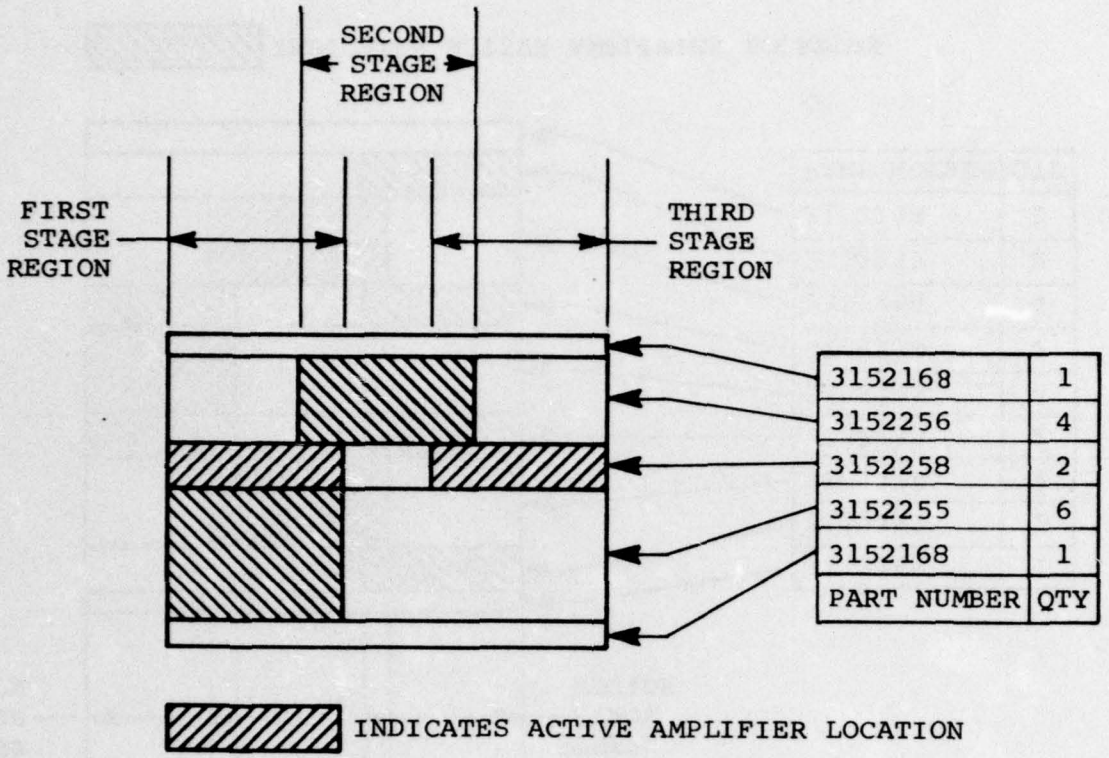



FIGURE 5

STACKING ORDER
THREE-STAGE AMPLIFIER NO. 2

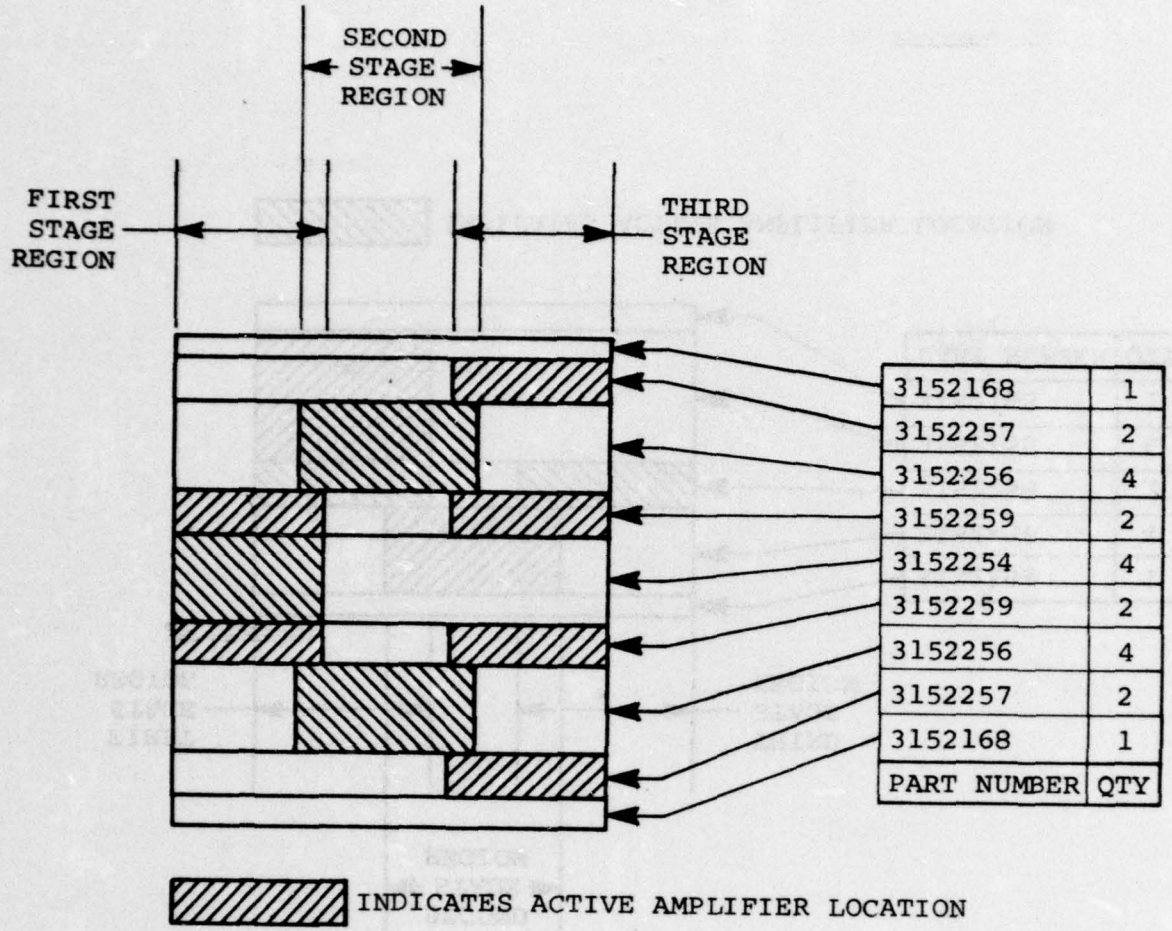



FIGURE 6

STACKING ORDER
THREE-STAGE AMPLIFIER NO. 3

TABLE III

SUPPLY PRESSURE

| | | | Temperature, Air | | | Temperature, Hydraulic Oil | | |
|---|---|---|---|---|---|---|---|---|
| | | | 298K | 353K | 408K | 289K | 305K | 330K |
| | | $\mu$, N·s/m$^2$ | $1.820 \times 10^{-5}$ | $2.096 \times 10^{-5}$ | $2.324 \times 10^{-5}$ | 0.0186-0.0197 | 0.0133-0.0142 | 0.00775-0.00827 |
| | | $\rho$, kg/m$^3$ | 1.186 | 1.000 | 0.865 | 869-871 | 859-860 | 842-843 |
| Configuration | | $N_R$ | $P_S$, $kP_a$ (gauge) | | | | | |
| Single-Stage Amplifier (2 Lam.) | | 42.5 | 1.28 | 1.98 | 2.84 | 2137 | 1014 | 345 |
| | | 85.0 | 5.15 | 7.95 | 11.30 | 8619 | 4000 | 1380 |
| Three-Stage Amplifier | 1st Stage (8 Lam.) | 42.5 | 0.06 | 0.09 | 0.13 | 103 | 48 | 16 |
| | | 85.0 | 0.24 | 0.37 | 0.52 | 427 | 200 | 62 |
| | 2nd Stage (4 Lam.) | 42.5 | 0.22 | 0.34 | 0.48 | 393 | 179 | 55 |
| | | 85.0 | 0.90 | 1.35 | 1.92 | 1448 | 690 | 234 |
| | 3rd Stage (2 Lam.) | 42.5 | 1.28 | 1.98 | 2.84 | 2137 | 1014 | 345 |
| | | 85.0 | 5.15 | 7.95 | 11.30 | 8619 | 4000 | 1380 |

NOTE: $N_R = \frac{L}{\mu}\sqrt{2P_S\rho}$

where, $L = \dfrac{b_S}{\left(\frac{\ell}{b_S} + 1\right)\left(1 + \frac{1}{\sigma}\right)^2}$

$b_S$ = Power jet width = $5.156 \times 10^{-4}$m

$\ell$ = Power jet length = $10.16 \times 10^{-4}$m

$\sigma$ = Aspect ratio = $\dfrac{(\text{No. Lam.})(1.016 \times 10^{-4})}{b_S}$

$N_R$ = Reynolds number

$\mu$ = Absolute viscosity

$\rho$ = Fluid density

$P_S$ = Supply pressure

Table IV lists the instrumentation used to record pressure, temperature, and flow rate during testing. Pressure transducers were calibrated for each test using either a water manometer or a Bourdon tube test gauge, depending on the range of pressures to be sensed. The range and accuracy of these instruments were as follows:

| Type | Range | Accuracy |
|---|---|---|
| Manometer | 0 to 1 in. $H_2O$ | ±0.01 in. $H_2O$ |
| Manometer | 0 to 60 in. $H_2O$ | ±0.05 in. $H_2O$ |
| Gauge | 0 to 100 psig | ±0.5 psig |
| Gauge | 0 to 160 psig | ±1.0 psig |
| Gauge | 0 to 600 psig | ±1.0 psig |
| Gauge | 0 to 1000 psig | ±1.0 percent |
| Gauge | 0 to 3000 psig | ±1.0 percent |

For airflow tests, a pressure drop of 1.0 in. $H_2O$ across the flowmeter corresponds to a flow rate of $6.23 \times 10^{-6}$ $m^3$/sec (0.0132 scfm). Using the low range water manometer to calibrate the flow section pressure transducer yields a flow measurement accuracy of $\pm 6.23 \times 10^{-8}$ $m^3$/sec (±0.000132 scfm). Measured flow rates were corrected for ambient temperature as follows:

$$Q_{actual} = 0.90\ Q_{measured} \text{ at } 298K$$

$$Q_{actual} = 0.88\ Q_{measured} \text{ at } 353K$$

$$Q_{actual} = 0.79\ Q_{measured} \text{ at } 408K$$

Since the turbine flowmeter used for the hydraulic flow measurements was sensitive to kinematic viscosity, the test data had to be corrected in accordance with the calibration curve on Figure 7. The accuracy of hydraulic flow measurements therefore depends on the errors in measurement of viscosity, temperature, and frequency. It is estimated that these combined errors result in a tolerance of ±3 percent of the measured values of hydraulic flow rate.

Test results presented in this report require calculation of gain and impedance based on the slope of specific X-Y plots. These calculations involve individual interpretation and therefore are subject to additional error. For example, gain measurements made by several persons were found to vary by ±5 percent for the same test data.

TABLE IV

TEST INSTRUMENTATION

| | Manufacturer | Model | Type | Range | Remarks |
|---|---|---|---|---|---|
| Air Tests | Pace Engineering Co. | P7D | Differential pressure | ±0.5 psid | Diaphragm replaced for low pressure measurements. |
| | Validyne Engineering Co. | DP45 | Differential pressure | ±1.0 in. $H_2O$ | Used to measure ΔP on Meriam Laminar Flow Meter. |
| | Scott & Fetzer Co., Meriam Instrument Div. | 50MK10 | Laminar flowmeter | 0.046 CFM at 70F and 29.92 in. Hg | Test data corrected for temperature after tests completed. |
| Hydraulic Tests | Viatran | 209C27 | Differential pressure | ±5000 psid<br>±1000 psid<br>±10 psid | |
| | Statham | PM280TC | Differential pressure | ±100 psid<br>±50 psid | |
| | Taber Instrumentation | 2102 | Differential pressure | ±300 psid | |
| | Omniflow | FTM-2-LB | Turbine flowmeter | 0.02 to 0.2 gpm | Pulse type output converted to analog with Hewlett Packard Model 500BR frequency meter. |
| Air and Hydraulic Test | Leeds & Northrup | | Potentiometer | -100F to +500F | Uses Iron-Constantin thermocouple for measuring supply temperature. |

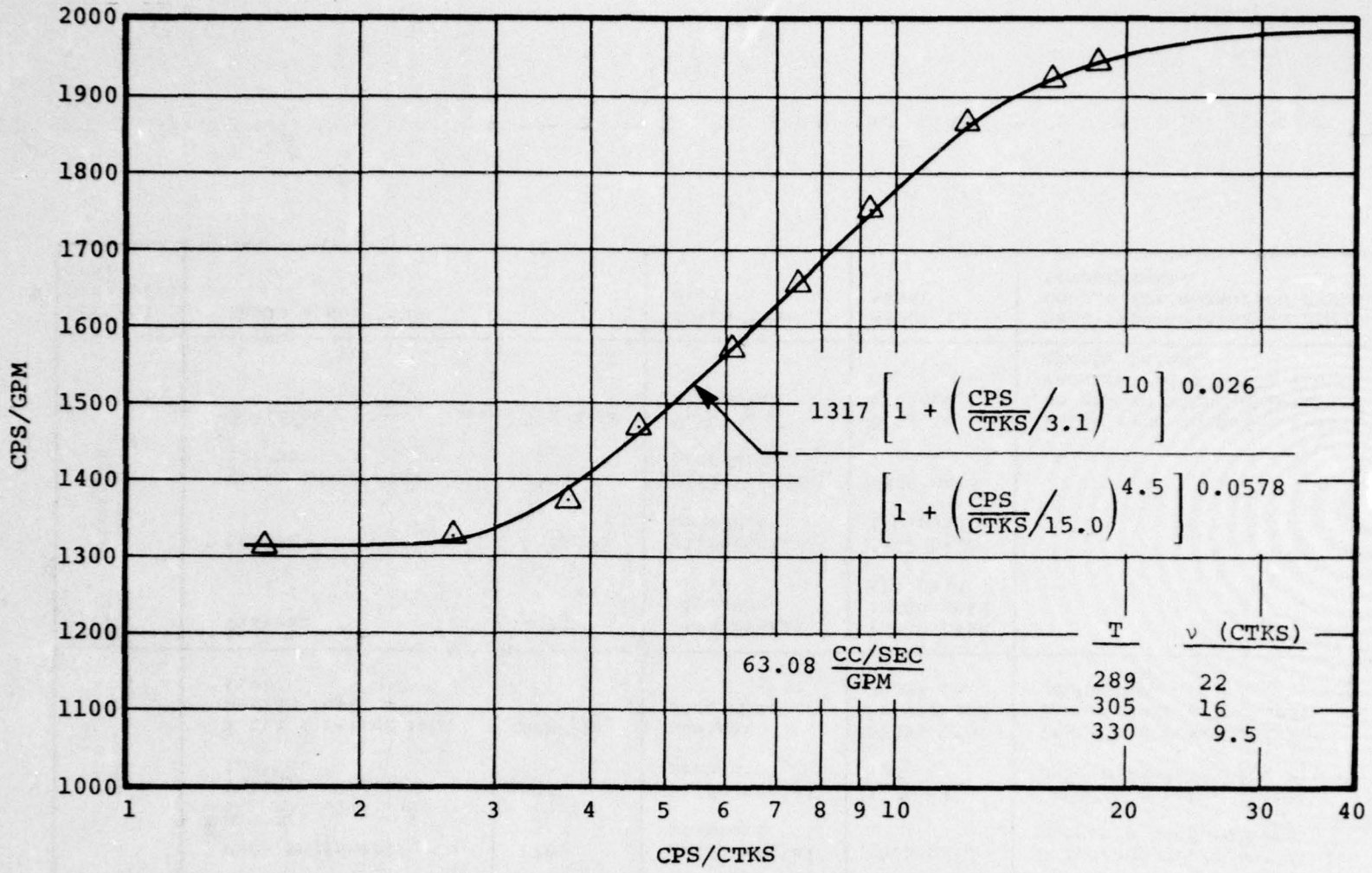



FIGURE 7

TURBINE METER CALIBRATION FM275 MIL-H-5606B

## SECTION 2

## TEST PLAN AND PROCEDURES

### 2.1 TEST PLAN

The single-stage laminar amplifiers and three-stage laminar amplifier circuits, fabricated for this program, were subjected to tests to determine the following parameters:

1. Pressure gain, $N_R$ = constant
2. Pressure gain, $P_s$ = constant (air only)
3. Pressure gain under vibration conditions (air only)
4. Common mode rejection ratio
5. Input impedance, centered jet, $N_R$ = constant
6. Input impedance, centered jet, $P_s$ = constant (air only)
7. Input impedance, deflected jet, $N_R$ = constant
8. Input impedance, deflected jet, $P_s$ = constant (air only)
9. Output impedance, $N_R$ = constant
10. Output impedance, $P_s$ = constant (air only)
11. Power jet impedance

The amplifiers and circuits were tested with both air and hydraulic oil according to the test schedules presented in Tables V and VI, respectively. Figures 8 and 9 show typical test setups for air and hydraulic tests. When full open, valves V1 and V2 were equivalent to a 3/32-inch diameter orifice for air tests and a 3/16-inch diameter orifice for hydraulic tests.

TABLE V

TEST SCHEDULE, AIR TESTS

| Air Tests | Single-Stage Amplifier | | | | | | Three-Stage Amplifier | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2.3.1.004A Temperature, K | | | 2.3.4.004 Temperature, K | | | 1 Temperature, K | | | 2 Temperature, K | | | 3 Temperature, K | | |
| | 298 | 353 | 408 | 298 | 353 | 408 | 298 | 353 | 408 | 298 | 353 | 408 | 298 | 353 | 408 |
| (1) Gain, $N_R$ = 85 and 42.5 | | | | | | | | | | | | | | | |
| $P_{\bar{C}}$ = 0 ∞/amp | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| $P_{\bar{C}}$ = 0.05 $P_s$ ∞/amp | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| $P_{\bar{C}}$ = 0.10 $P_s$ ∞/amp | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| (2) Gain, $P_s$ = constant | | | | | | | | | | | | | | | |
| $P_{\bar{C}}$ = 0 ∞/amp | | | | | | | X | X | X | X | X | X | X | X | X |
| $P_{\bar{C}}$ = 0.05 $P_s$ ∞/amp | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| $P_{\bar{C}}$ = 0.10 $P_s$ ∞/amp | | | | | | | X | X | X | X | X | X | X | X | X |
| (3) Gain, Vibration $N_R$ = 85 and 42.5 | | | | | | | | | | | | | | | |
| $P_{\bar{C}}$ = 0, Loaded, X-Axis | X | | | X | | | | | | | | | X | | |
| $P_{\bar{C}}$ = 0, Loaded, Y-Axis | X | | | X | | | | | | | | | X | | |
| $P_{\bar{C}}$ = 0, Loaded, Z-Axis | X | | | X | | | | | | | | | X | | |
| (4) Common Mode Rejection $N_R$ = 85 and 42.5 | | | | | | | | | | | | | | | |
| $P_{\bar{C}}$ = Various, ∞/amp | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| (5) Input Impedance, C.J. $N_R$ = 85 and 42.5 | | | | | | | | | | | | | | | |
| $P_{\bar{C}}$ = Various, ∞/amp | X | X | X | X | X | X | | | | | | | | | |
| (6) Input Impedance, C. J. $P_s$ = Constant | | | | | | | | | | | | | | | |
| $P_{\bar{C}}$ = Various, ∞/amp | X | X | X | X | X | X | | | | | | | | | |
| (7) Input Impedance, D.J. $N_R$ = 85 and 42.5 | | | | | | | | | | | | | | | |
| $P_{\bar{C}}$ = Various, ∞/Amp | X | X | X | X | X | X | | | | | | | | | |
| (8) Input Impedance, D.J. $P_s$ = Constant | | | | | | | | | | | | | | | |
| $P_{\bar{C}}$ = Various, ∞/Amp | X | X | X | X | X | X | | | | | | | | | |
| (9) Output Impedance $N_R$ = 85 and 42.5 | | | | | | | | | | | | | | | |
| $P_{\bar{C}}$ = 0 | X | X | X | X | X | X | | | | | | | | | |
| $P_{\bar{C}}$ = .05 $P_s$ | X | X | X | X | X | X | | | | | | | | | |
| $P_{\bar{C}}$ = .10 $P_s$ | X | X | X | X | X | X | | | | | | | | | |
| (10) Output Impedance $P_s$ = Constant | | | | | | | | | | | | | | | |
| $P_{\bar{C}}$ = 0 | X | X | X | X | X | X | | | | | | | | | |
| $P_{\bar{C}}$ = .05 $P_s$ | X | X | X | X | X | X | | | | | | | | | |
| $P_{\bar{C}}$ = .10 $P_s$ | X | X | X | X | X | X | | | | | | | | | |
| (11) Power Jet Impedance $P_s$ = Variable | | | | | | | | | | | | | | | |
| $P_{\bar{C}}$ = 0 ∞ | X | X | X | X | X | X | | | | | | | | | |

TABLE VI

TEST SCHEDULE, HYDRAULIC TESTS

| Hydraulic Tests | Single-Stage Amplifier | | | | | | Three-Stage Amplifier | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2.3.1.004F Temperature, K | | | 2.3.4.004 Temperature, K | | | 1 Temperature, K | | | 2 Temperature, K | | | 3 Temperature, K | | |
| | 289 | 305 | 330 | 289 | 305 | 330 | 289 | 305 | 330 | 289 | 305 | 330 | 289 | 305 | 330 |
| (1) Gain, $N_R$ = 85 and 42.5 | | | | | | | | | | | | | | | |
| $P_{\bar{C}}$ = 0 ∞/amp | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| $P_{\bar{C}}$ = .05 $P_s$ ∞/amp | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| $P_{\bar{C}}$ = .10 $P_s$ ∞/amp | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| (2) Common Mode Rejection $N_R$ = 85 and 42.5 | | | | | | | | | | | | | | | |
| $P_{\bar{C}}$ = various, ∞/amp | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| (3) Input Impedance, C.J. $N_R$ = 85 and 42.5 | | | | | | | | | | | | | | | |
| $P_{\bar{C}}$ = Various, ∞/amp | X | X | X | X | X | X | | | | | | | | | |
| (4) Input Impedance, D.J. $N_R$ = 85 and 42.5 | | | | | | | | | | | | | | | |
| $P_{\bar{C}}$ = Various, ∞/amp | X | X | X | X | X | X | | | | | | | | | |
| (5) Output Impedance $N_R$ = 85 and 42.5 | | | | | | | | | | | | | | | |
| $P_{\bar{C}}$ = 0 | X | X | X | X | X | X | | | | | | | | | |
| $P_{\bar{C}}$ = .05 $P_s$ | X | X | X | X | X | X | | | | | | | | | |
| $P_{\bar{C}}$ = .10 $P_s$ | X | X | X | X | X | X | | | | | | | | | |
| (6) Power Jet Impedance $P_s$ = Variable | | | | | | | | | | | | | | | |
| $P_{\bar{C}}$ = 0, ∞ | X | X | X | X | X | X | | | | | | | | | |

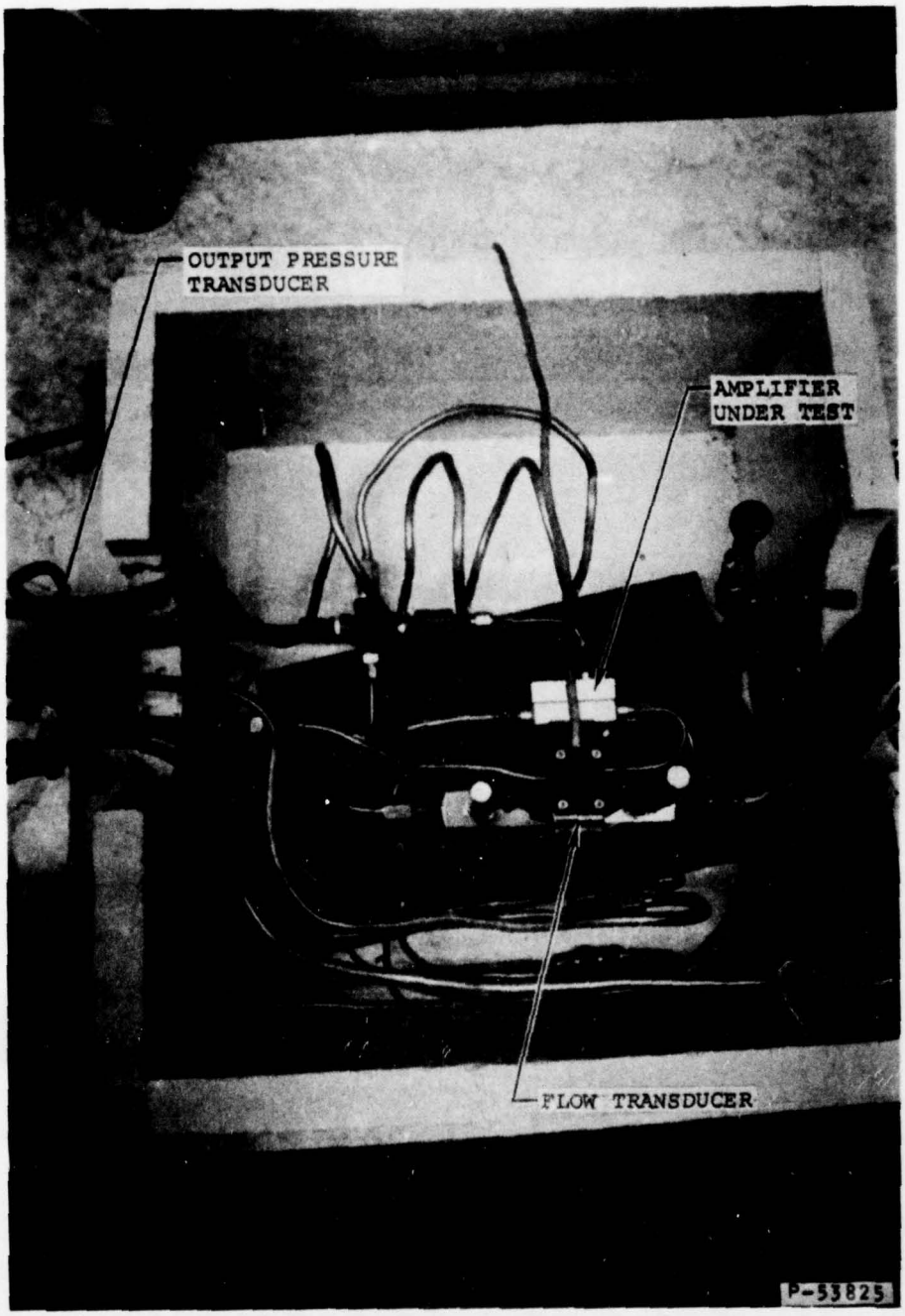



FIGURE 8

AIR TEST SETUP
IN AMBIENT BOX
(SEE FIGURE 19)

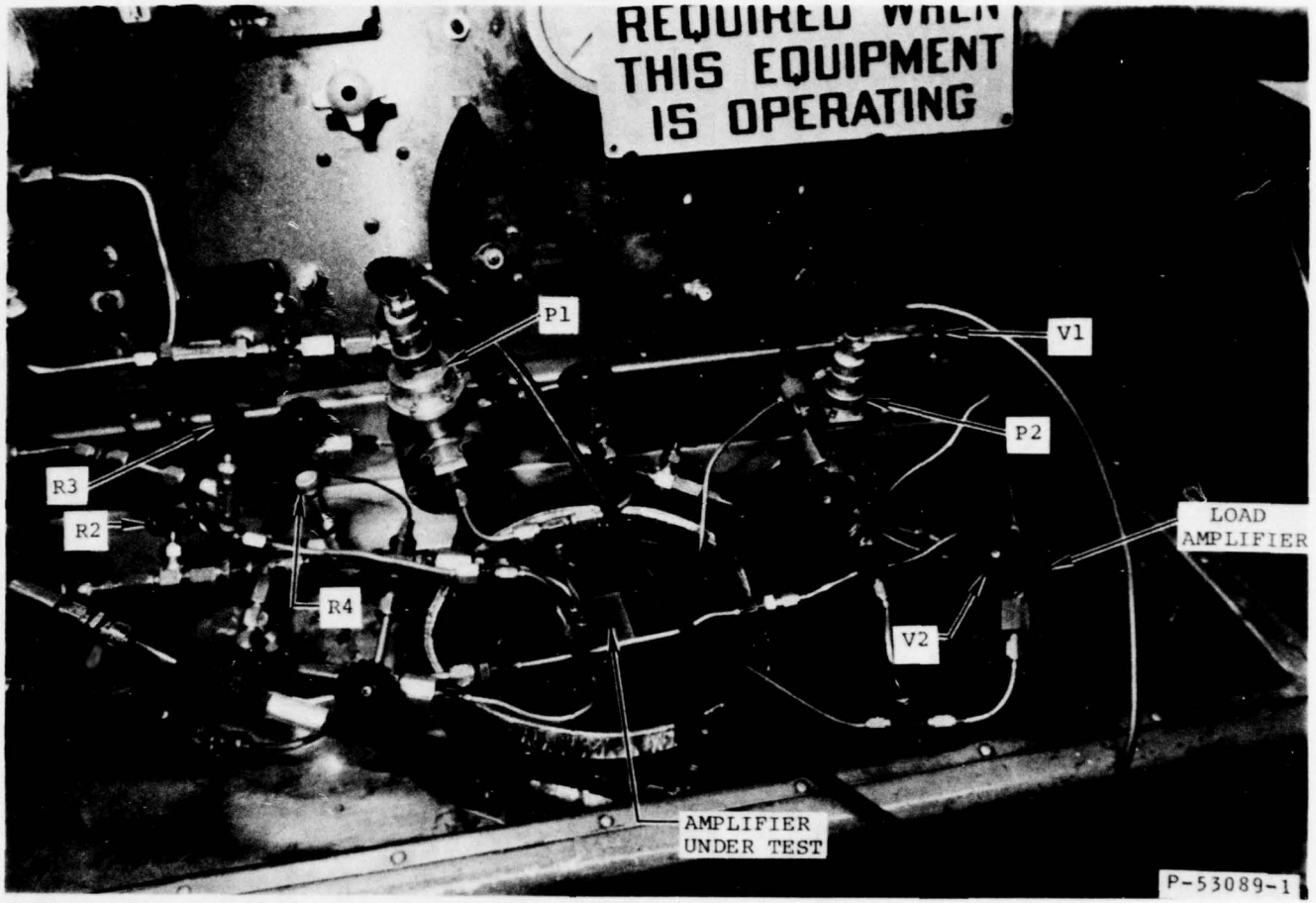



FIGURE 9

HYDRAULIC TEST SETUP
(SEE FIGURE 10)

## 2.2 TEST PROCEDURES

### 2.2.1 Air Tests

2.2.1.1 Pressure Gain, $N_R$ = Constant - The single-stage and three-stage amplifiers were installed in test fixtures and connected as shown in Figures 10 and 11, respectively. Each test fixture was located in an insulated container so that the ambient temperature could be stabilized at 298K, 353K, and 408K. The following procedure was used to record differential output pressure vs differential control pressure for constant power jet Reynolds numbers. The pressure gain is the slope of this curve.

1. Valves V1 and V2 were closed.
2. R1 was adjusted to 69 kilopascals (10 psig).
3. R2, R5, and R6 were adjusted, as applicable, to the pressures shown in Table III for an ambient temperature of 298K and a power jet Reynolds number of 85.
4. With R3 and R4 initially adjusted to zero gauge pressure, a plot of pressure gain ($\Delta P_{out}$ vs $\Delta P_{control}$) was made by increasing the control pressure on one side and returning to the initial value, and then repeating this for the other control pressure.†
5. Step 4 was repeated with initial control pressure levels of 5 percent and 10 percent of the supply pressure.
6. Steps 3 through 5 were repeated for ambient temperatures of 353K and 408K.
7. Steps 3 through 6 were repeated for $N_R$ = 42.5.
8. Steps 3 through 7 were repeated with valves V1 and V2 open, with the amplifier then loaded by a self-similar device.

† This procedure does not result in a transfer characteristic at constant bias. Under ideal conditions of ∞ CMRR, the slope at zero differential pressure would be the gain at that bias; however, since there are asymmetries and since the bias is increasing during a scan, the resulting measured gain must of necessity be lower than that of the ideal case.

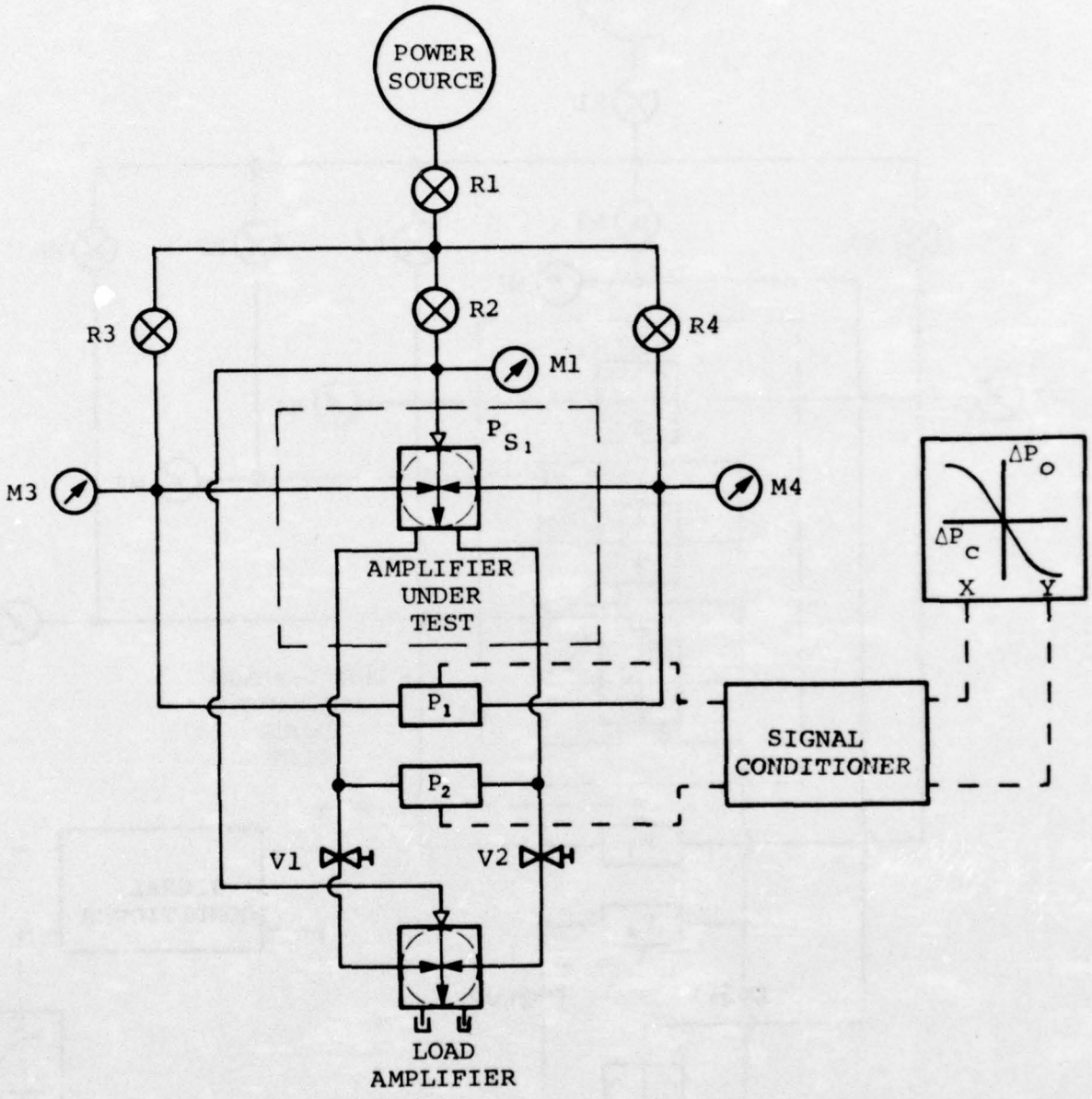



FIGURE 10

TEST SETUP, SINGLE-STAGE PRESSURE GAIN

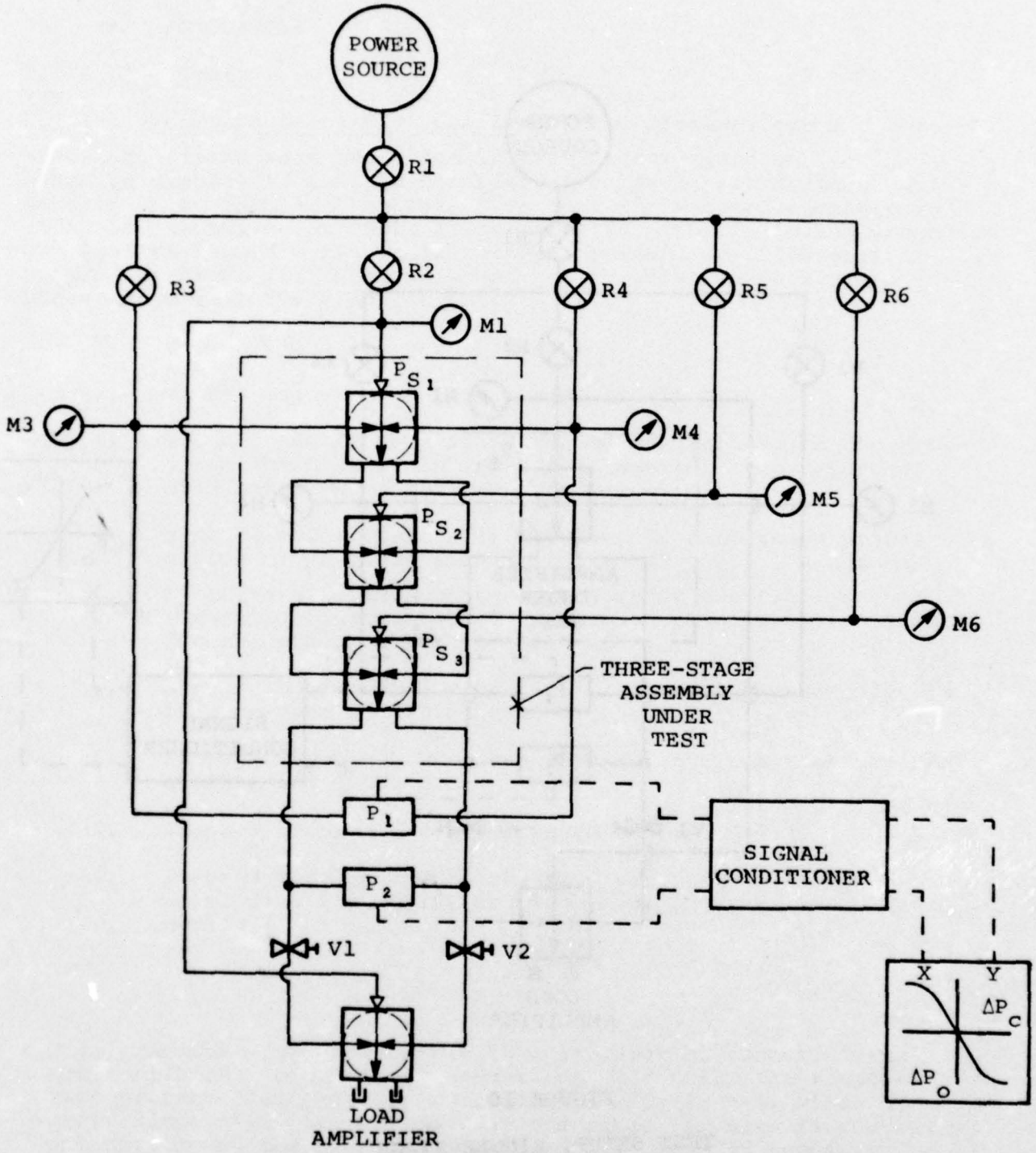



FIGURE 11

TEST SETUP, THREE-STAGE PRESSURE GAIN

2.2.1.2 Pressure Gain, $P_s$ = Constant - The single-stage and three-stage amplifiers were installed in test fixtures and connected as shown in Figures 10 and 11, respectively. Each test fixture was located in an insulated container so that the ambient temperature could be stabilized at 298K, 353K, and 408K. The following procedure was used to record differential output pressure vs differential control pressure at constant supply pressure.

1. Valves V1 and V2 were closed.

2. R1 was adjusted to 69 kilopascals (10 psig).

3. R2, R5, and R6 were adjusted, as applicable, to the pressure shown in Table III corresponding to $N_R$ = 85 at a temperature of 353K.

4. The ambient temperature was stabilized at 298K.

5. R3 and R4 were adjusted to 5 percent of the supply pressure and a plot of pressure transfer characteristic ($\Delta P_{out}$ vs $\Delta P_{control}$) was made by increasing the control pressure on one side and returning to the initial value, and then repeating this for the other side control pressure.

6. Steps 3 and 5 were repeated with the ambient temperature stabilized at 353K and 408K.

7. Steps 2 through 6 were repeated with valves V1 and V2 open, thus loading the amplifier with a self-similar device.

8. Steps 1 through 7 were repeated with R2, R5, and R6 adjusted in step 3 to the pressures shown in Table III corresponding to $N_R$ = 42.5 and a temperature of 353K.

2.2.1.3 Pressure Gain, Vibration - The single-stage and three-stage amplifiers were installed in separate test fixtures and connected as shown in Figures 10 and 11, respectively. Each test fixture in turn was mounted on a vibration test stand; the load amplifier and pressure transducers were mounted off the stand. Figures 12, 13, and 14 show the three-stage amplifier mounted on the vibration test stand. The vibration gain test was performed at room temperature using the following procedure (refer to Figures 10 and 11).

1. The test fixture was mounted on the vibration table and oriented to test X-axis sensitivity.

2. Valves V1 and V2 were open to load the amplifiers.

3. R1 was adjusted to 69 kilopascals (10 psig).

4. R2, R5, and R6 were adjusted, as applicable, to the pressures shown in Table II for $N_R$ = 85 and a temperature of 298K.

5. With R3 and R4 initially adjusted to zero gauge pressure, a plot of pressure gain ($\Delta P_{out}$ vs $\Delta P_{control}$) was made by increasing the control pressure on one side, returning to the initial value, then repeating this procedure for the other control pressure. The local ambient temperature was recorded.

6. With the gain curve still on the plotter and a control pressure producing a differential output pressure of approximately 50 percent of saturation, a vibration scan was made in the range 5 to 1000 Hz at an amplitude of 10g. The plotter was monitored for any evidence of gain change or shift while the output pressure was simultaneously monitored on an oscilloscope. A gain curve was retraced if there was any deviation, and the frequency was noted.

7. Steps 5 and 6 were repeated with the supply pressure corresponding to $N_R$ = 42.5 and a temperature of 298K.

8. Steps 2 through 7 were repeated with the test fixture oriented in turn to apply vibration in the Y- and Z-axes.

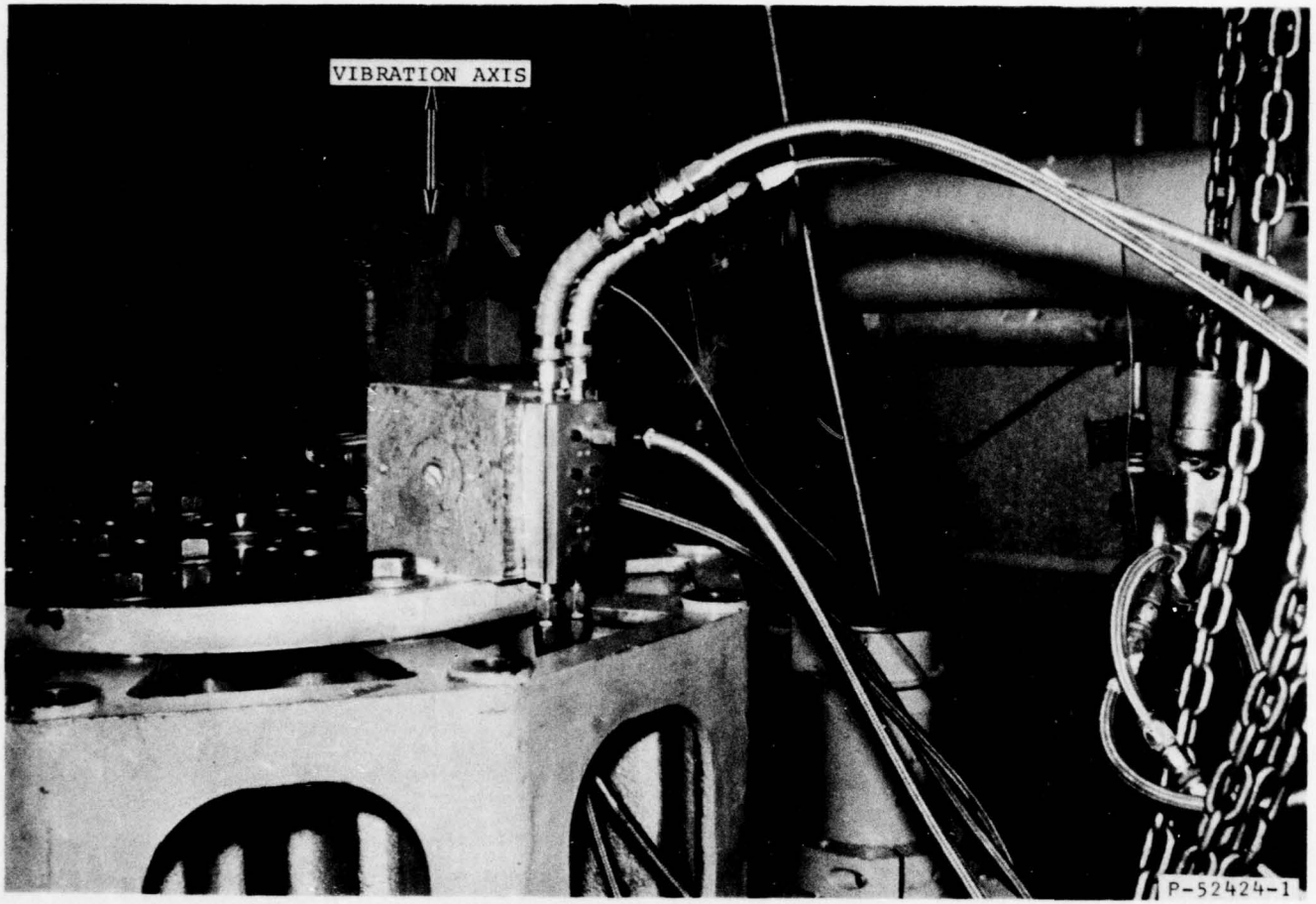



FIGURE 13

VIBRATION TEST, Y-AXIS
THREE-STAGE FLUIDIC AMPLIFIER

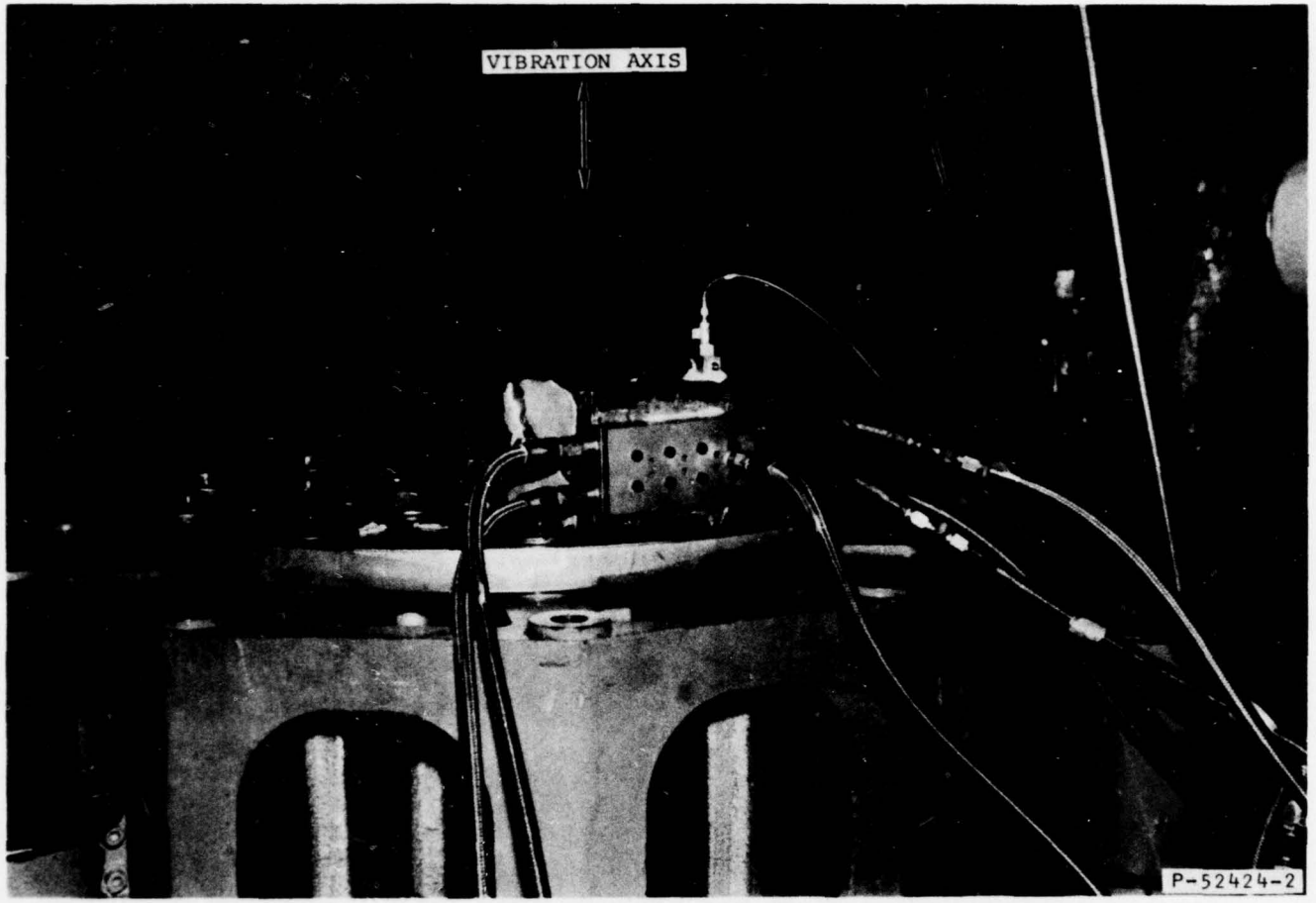



FIGURE 12

VIBRATION TEST, X-AXIS
THREE-STAGE FLUIDIC AMPLIFIER

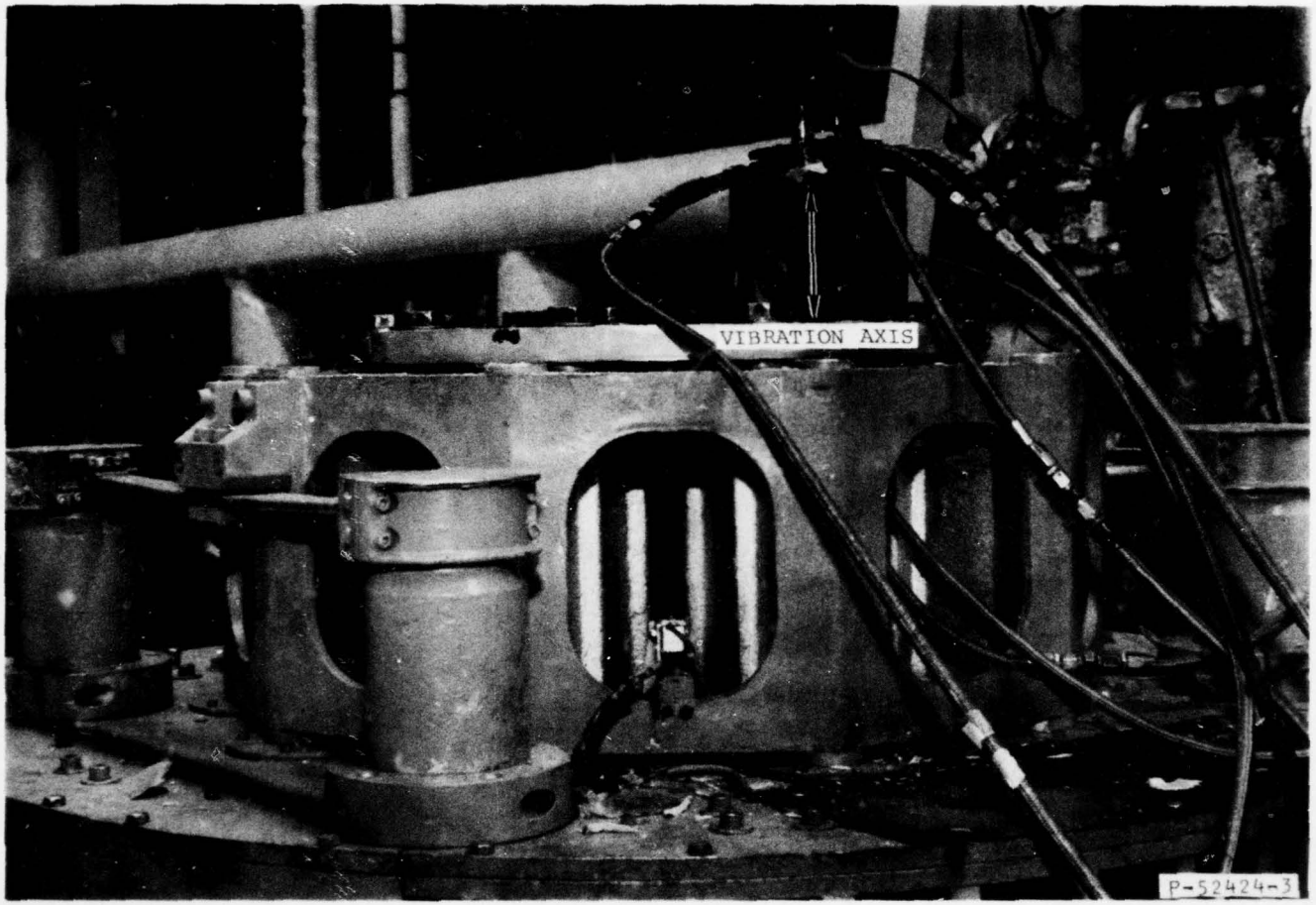



FIGURE 14

VIBRATION TEST, Z-AXIS
THREE-STAGE FLUIDIC AMPLIFIER

2.2.1.4 Common Mode Rejection - The single-stage and three-stage amplifiers were installed in separate test fixtures and connected as shown in Figures 15 and 16, respectively. Each test fixture was located in an insulated container so that the ambient temperature could be stabilized at 298K, 353K, and 408K. The following procedure was used to record differential output pressure vs control pressure bias level for determination of the common mode rejection ratio.

1. Valves V1 and V2 were closed.

2. R1 was adjusted to 69 kilopascals (10 psig).

3. R2, R5, and R6 were adjusted, as applicable, to the pressures shown in Table III for an ambient temperature of 298K and $N_R$ = 85.

4. The control pressure level was increased from zero gauge pressure to 10 percent of the supply pressure and the differential output vs control bias pressure level was plotted.

5. Steps 3 and 4 were repeated for ambient temperatures of 353K and 408K.

6. Steps 3 through 5 were repeated for $N_R$ = 42.5.

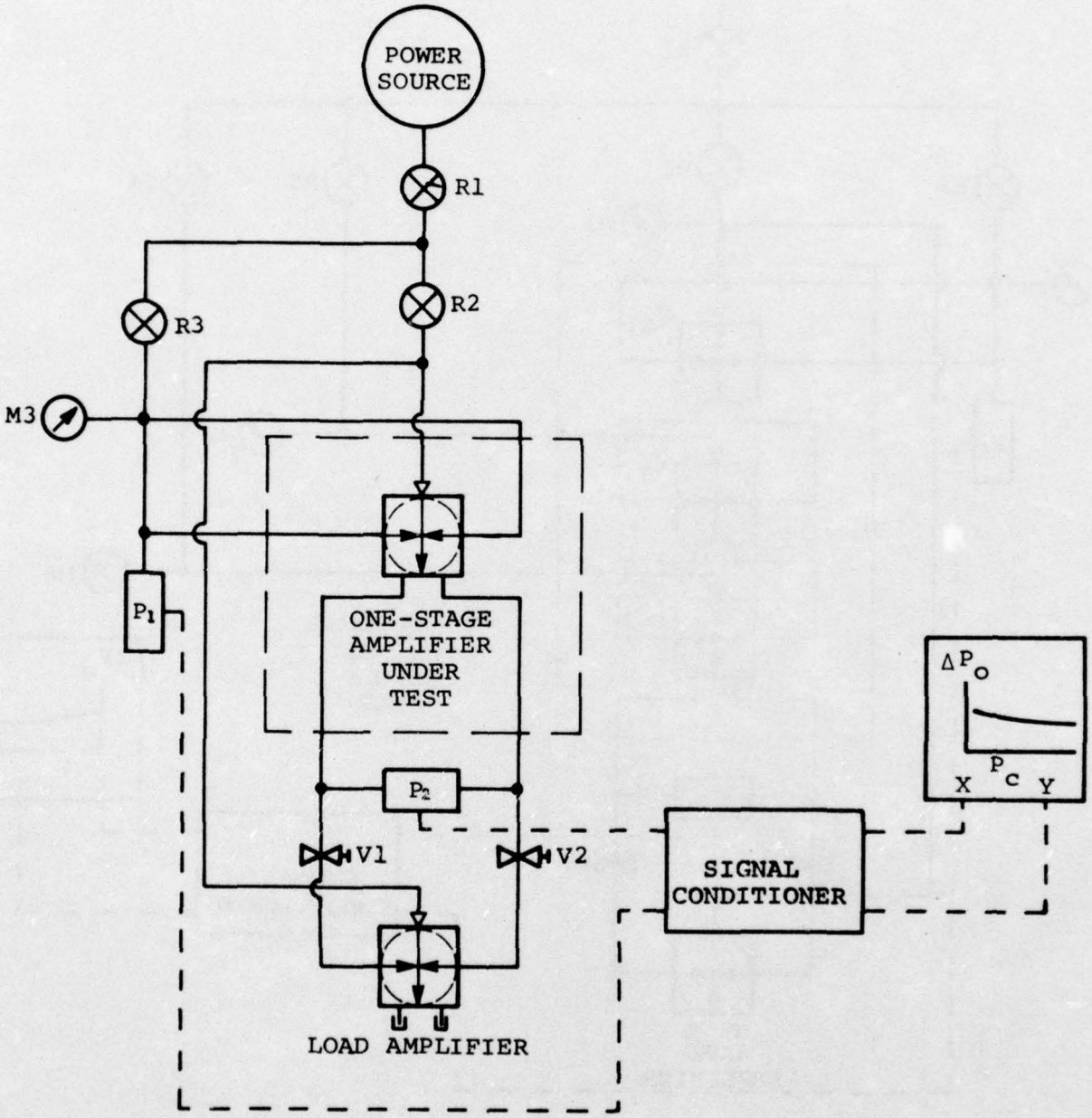



FIGURE 15

TEST SETUP, SINGLE-STAGE
COMMON MODE REJECTION

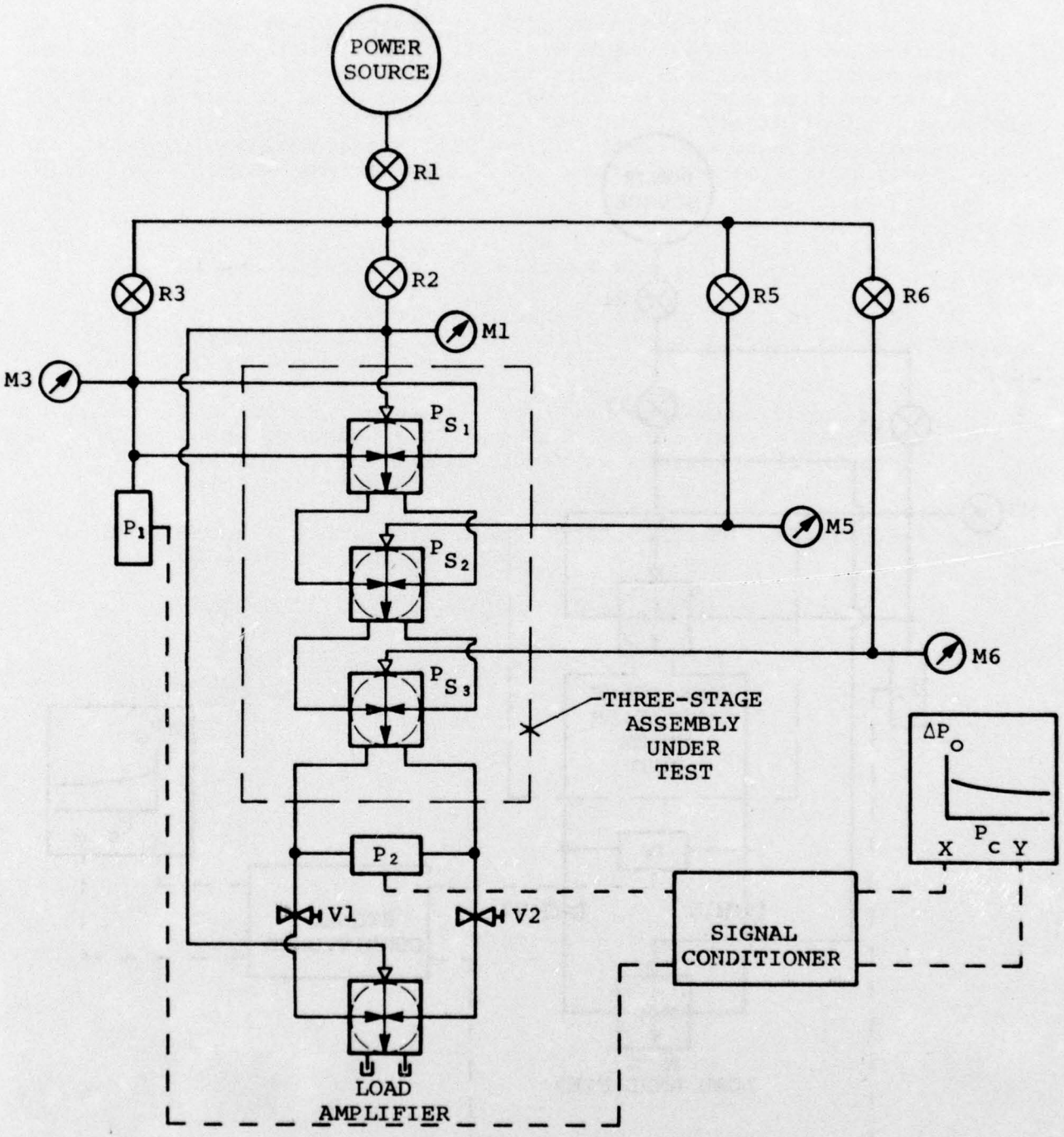



FIGURE 16

TEST SETUP, THREE-STAGE
COMMON MODE REJECTION

2.2.1.5 Input Impedance, Centered Jet, $N_R$ = Constant†† - The single-stage amplifier was installed in a test fixture and connected as shown in Figure 17. The test fixture was located in an insulated container so that the ambient temperature could be stabilized at 298K, 353K, and 408K. The following procedure was used to record control flow vs control pressure level at constant power jet Reynolds numbers.

1. Valves V1 and V2 were closed.
2. R1 was adjusted to 69 kilopascals (10 psig).
3. R2 was adjusted to the pressure shown in Table III for an ambient temperature of 298K and $N_R$ = 85.
4. Control pressure was varied from 0 to 30 percent of supply pressure and a plot of control flow vs control pressure was made.
5. Steps 3 and 4 were repeated for ambient temperatures of 353K and 408K.
6. Steps 3 through 5 were repeated for $N_R$ = 42.5.
7. Steps 3 through 6 were repeated with Valves V1 and V2 open.
8. The instrumentation was reversed to measure opposite control port characteristics, after which Steps 1 through 7 were repeated.

†† Due to problems in setting the experimental program up, the flowmeter was inadvertently put into one control channel only resulting in slightly different flows on each side of the amplifier. This then in reality deflects the jet a bit so that the measured values of impedance will be high because the jet is deflected to the flowmeter side.

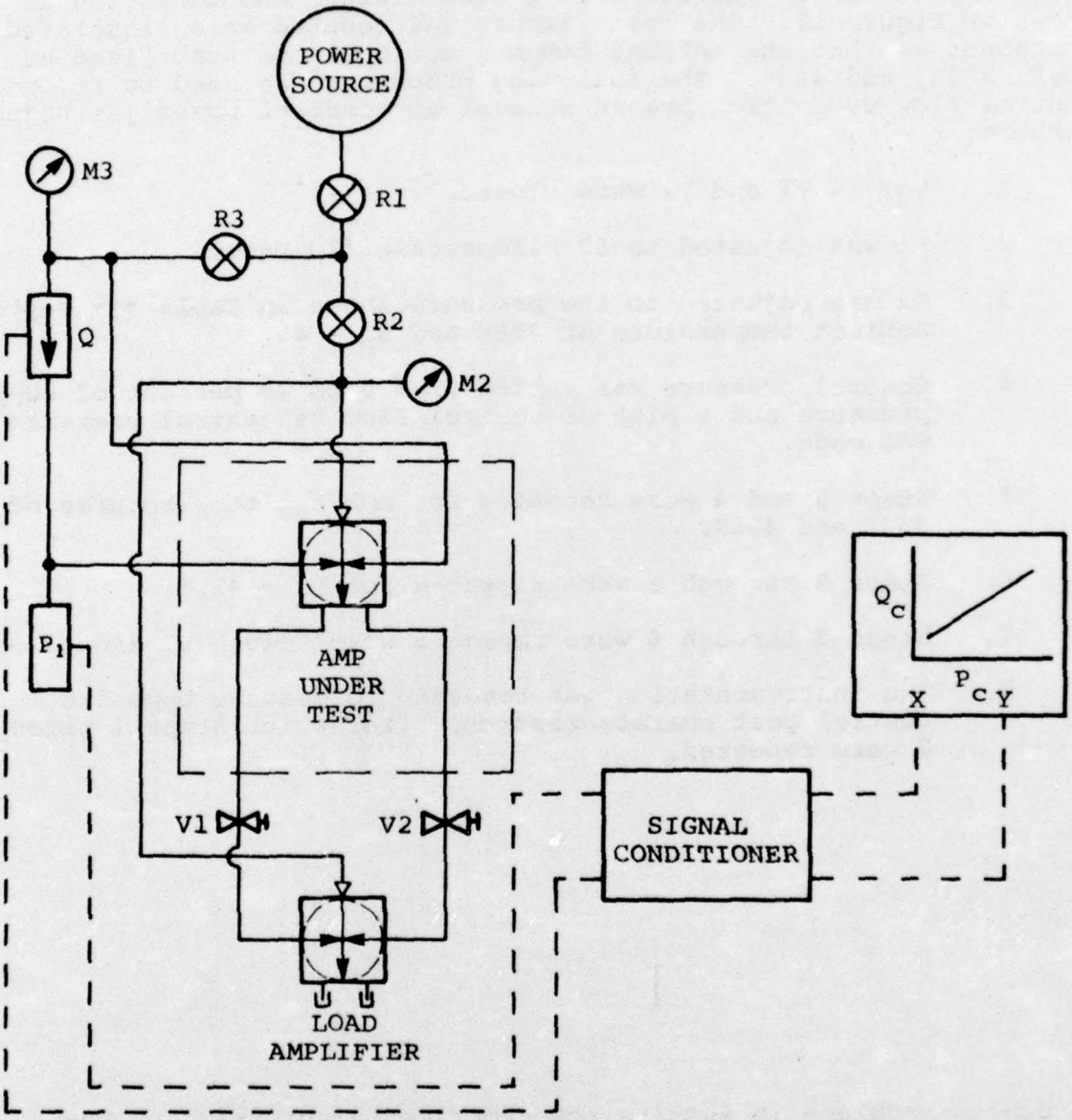



FIGURE 17

TEST SETUP, INPUT IMPEDANCE
CENTERED JET

2.2.1.6 Input Impedance, Centered Jet, $P_s$ = Constant** - The single-stage amplifier was installed in a test fixture and connected as shown in Figure 17. The test fixture was located in an insulated container so that the ambient temperature could be stabilized at 298K, 353K, and 408K. The following procedure was used to record control flow vs control pressure level at constant supply pressure.

1. Valves V1 and V2 were closed.
2. R2 was adjusted to 69 kilopascals (10 psig).
3. R2 was adjusted to the pressure shown in Table III corresponding to $N_R$ = 85 at a temperature of 353K.
4. The ambient temperature was stabilized at 298K.
5. Control pressure was varied from 0 to 30 percent of supply pressure and a plot of control flow vs control pressure was made.
6. Steps 3 and 5 were repeated at ambient temperatures of 353K and 408K.
7. Steps 3 through 6 were repeated with the supply pressure corresponding to $N_R$ = 42.5 at 353K.
8. Steps 3 through 7 were repeated with valves V1 and V2 open.
9. The instrumentation was reversed to measure opposite control port characteristics, after which steps 1 through 8 were repeated.

** Due to problems in setting the experimental program up, the flowmeter was inadvertently put into one control channel only resulting in slightly different flows on each side of the amplifier. This then in reality deflects the jet a bit so that the measured values of impedance will be high because of the jet is deflected to the flowmeter side.

2.2.1.7 Input Impedance, Deflected Jet, $N_R$ = Constant - The single-stage amplifier was installed in a test fixture and connected as shown in Figure 18. The test fixture was located in an insulated container so that the ambient temperature could be stabilized at 298K, 353K and 408K. The following procedure was used to record control flow vs differential control pressure for constant power jet Reynolds numbers.

1. Valves V1 and V2 were closed.

2. R1 was adjusted to 69 kilopascals (10 psig).

3. R2 was adjusted to the pressure shown in Table III for an ambient temperature of 298K and $N_R$ = 85. Ambient temperature was stabilized at 298K.

4. R4 was adjusted to 207 to 241 kilopascals (30-35 psig) in order to choke the fixed restrictor R5. Restrictor R6 and regulator R3 were adjusted until the control pressure level was 5 percent of the supply pressure. This resulted in a constant control flow on one control port.

5. R3 was adjusted to vary the differential control pressure between 0 and 30 percent of the supply pressure and a plot of control flow vs control differential pressure was made.

6. Steps 3 through 5 were repeated for ambient temperatures of 353K and 408K.

7. Steps 3 through 6 were repeated for $N_R$ = 42.5.

8. Steps 3 through 7 were repeated with valves V1 and V2 open.

2.2.1.8 Input Impedance, Deflected Jet, $P_s$ = Constant - The single-stage amplifier was installed in a test fixture and connected as shown in Figure 18. The fixture was located in an insulated container so that the ambient temperature could be stabilized at 298K, 353K, and 408K. The following procedure was used to record control flow vs differential control pressure for constant supply pressure.

1. Valves V1 and V2 were closed.

2. R1 was adjusted to 69 kilopascals (10 psig).

3. R2 was adjusted to the pressure shown in Table III sponding to $N_R$ = 85 at a temperature of 353K.

4. The ambient temperature was stabilized at 298K.

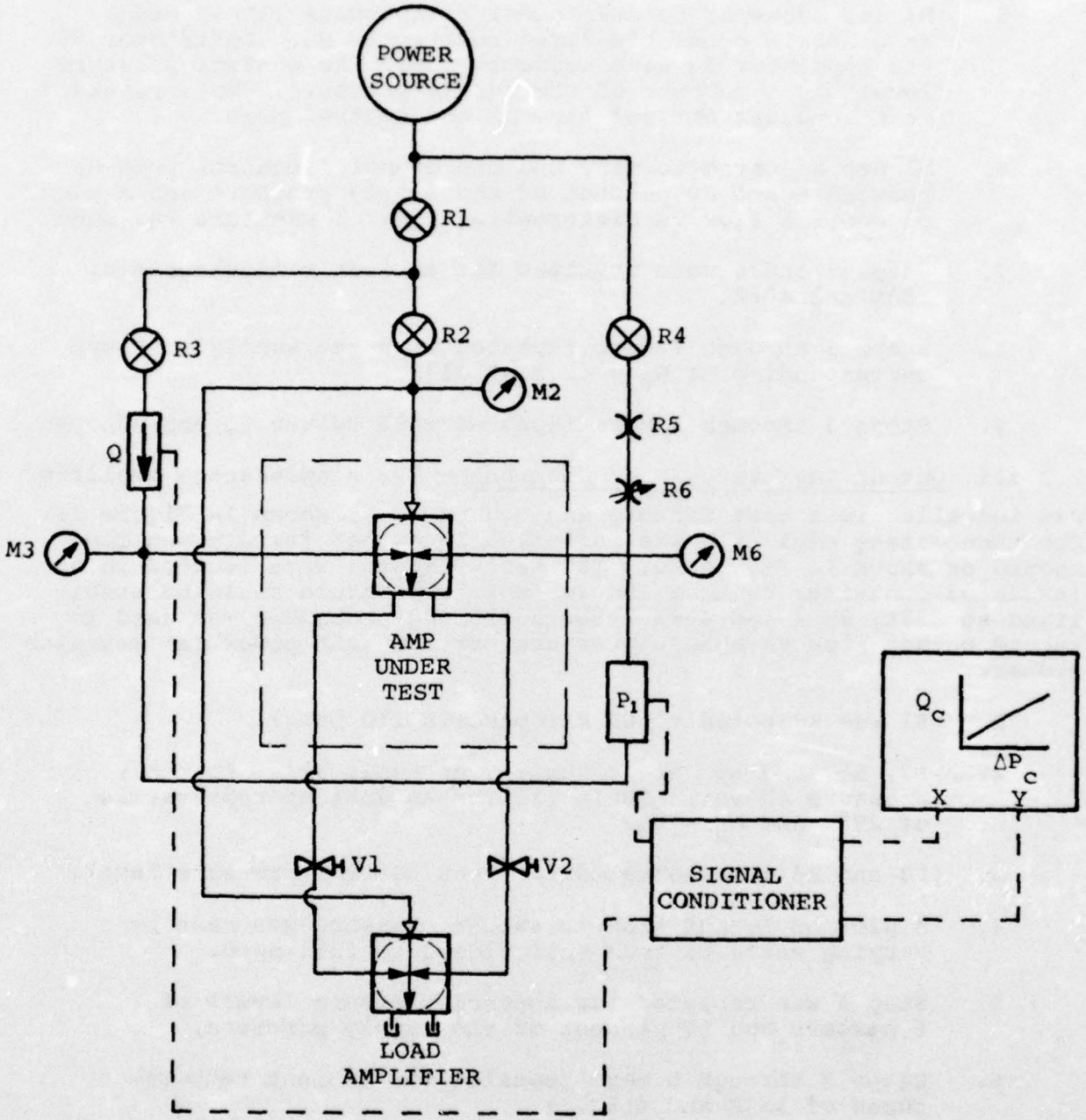



FIGURE 18

TEST SETUP, INPUT IMPEDANCE, DEFLECTED JET

5. R4 was adjusted to 207 to 241 kilopascals (30-35 psig) in order to choke the fixed restrictor R5. Restrictor R6 and regulator R3 were adjusted until the control pressure level was 5 percent of the supply pressure. This resulted in a constant control flow on one control port.

6. R3 was adjusted to vary the differential control pressure between 0 and 30 percent of the supply pressure and a plot of control flow vs differential control pressure was made.

7. Steps 3 and 6 were repeated for ambient temperatures of 353K and 408K.

8. Steps 3 through 7 were repeated with the supply pressure corresponding to $N_R$ = 42.5 at 353K.

9. Steps 3 through 8 were repeated with valves V1 and V2 open.

2.2.1.9 Output Impedance, $N_R$ = Constant - The single-stage amplifier was installed in a test fixture and connected as shown in Figure 19. The three-stage amplifier was installed in a test fixture and connected as shown in Figure 20. The test fixtures were located in an insulated container so that the ambient temperature could be stabilized at 298K, 353K and 408K. The following procedure was used to record output flow vs output pressure for constant power jet Reynolds numbers.

1. R1 was adjusted to 69 kilopascals (10 psig).

2. R2, R5, and R6 were adjusted, as applicable, to the pressure shown in Table III for an ambient temperature of 298K and $N_R$ = 85.

3. R3 and R4 were adjusted for zero control pressure level.

4. A plot of output flow vs output pressure was made by varying valve V1 from full closed to full open.

5. Step 4 was repeated for control pressure levels of 5 percent and 10 percent of the supply pressure.

6. Steps 2 through 5 were repeated for ambient temperatures of 353K and 408K.

7. Steps 2 through 6 were repeated for $N_R$ = 42.5.

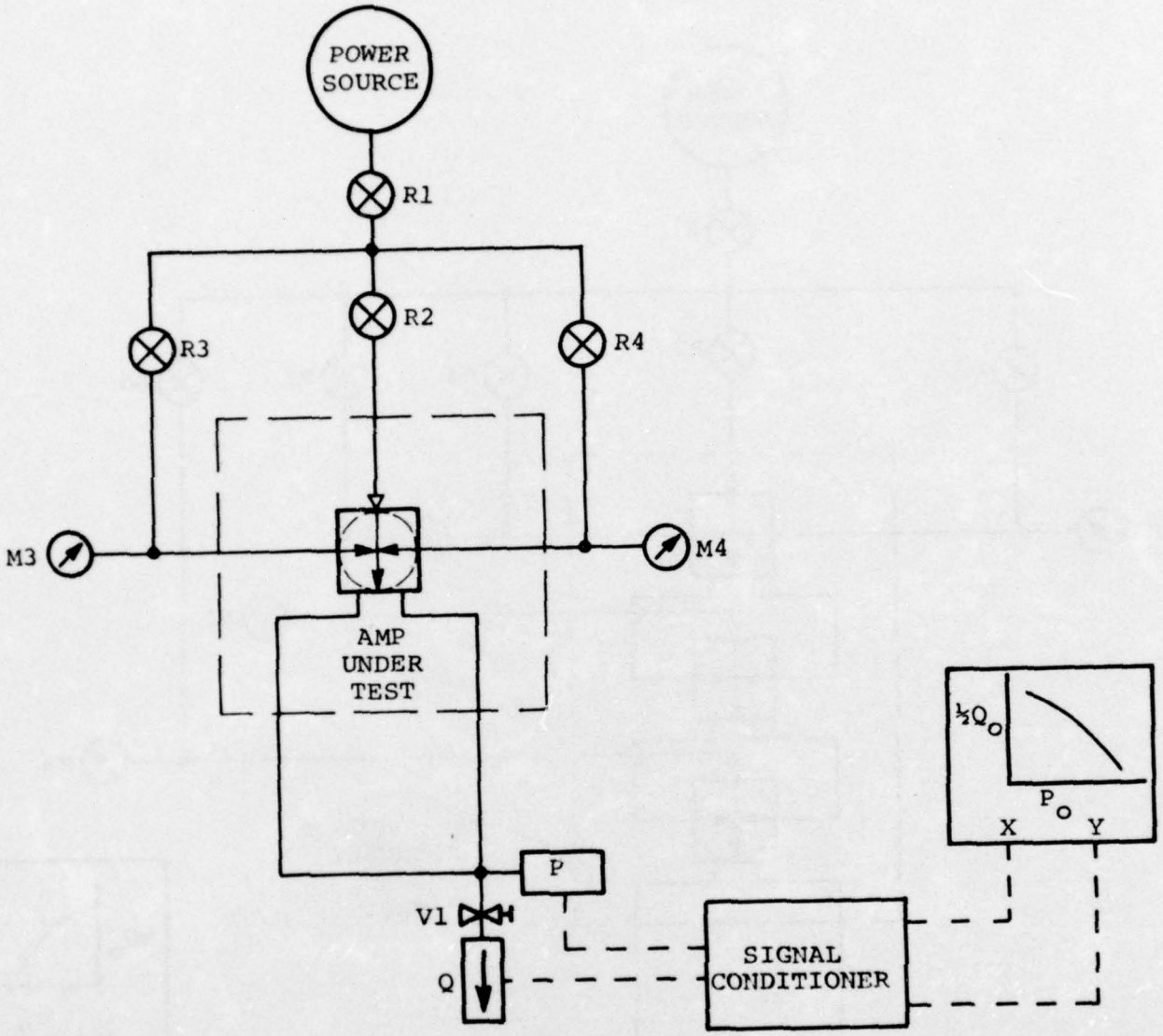



FIGURE 19

TEST SETUP, SINGLE-STAGE
OUTPUT IMPEDANCE

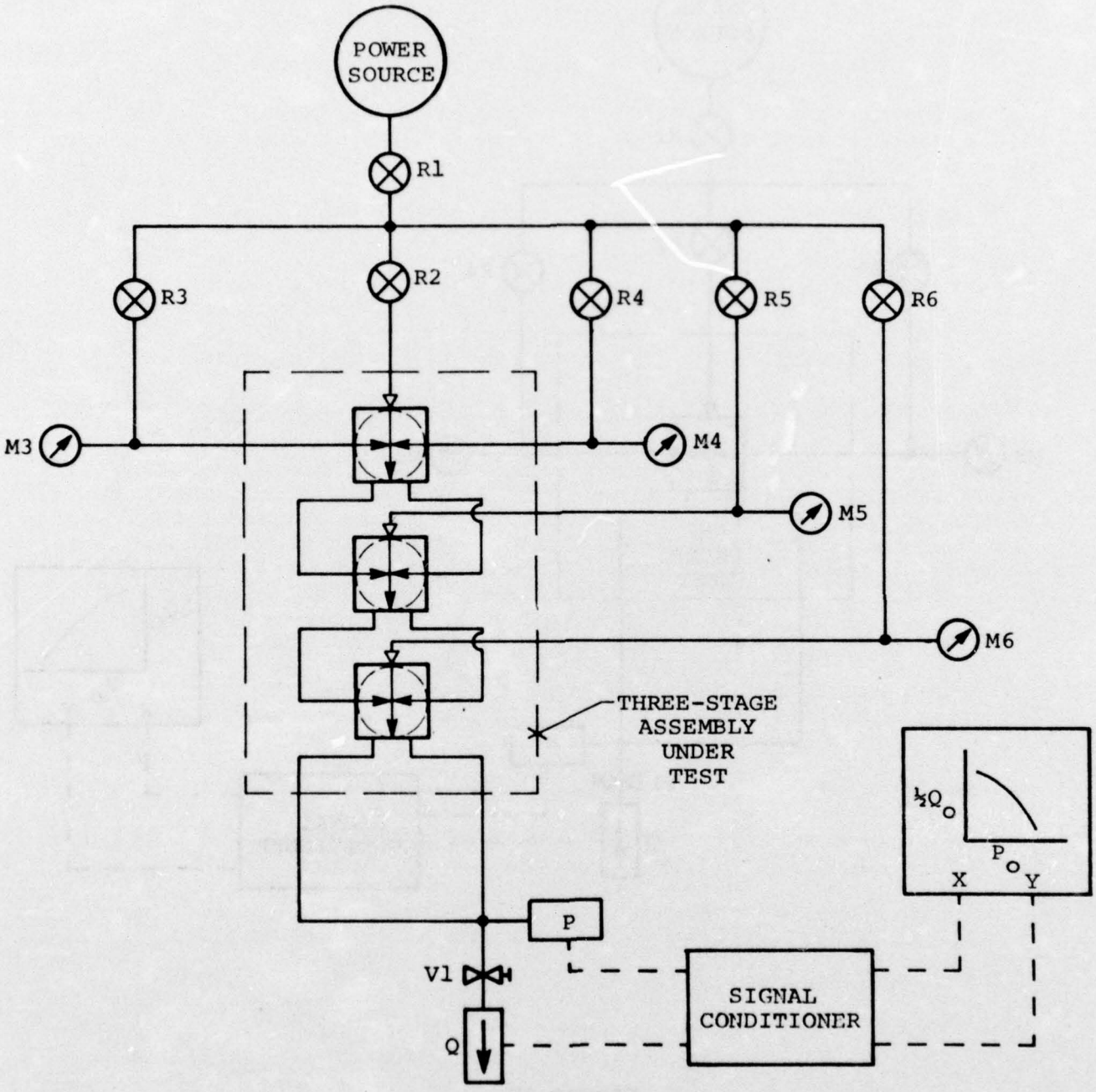



FIGURE 20

TEST SETUP, THREE-STAGE
OUTPUT IMPEDANCE

2.2.1.10 Output Impedance, $P_s$ = Constant - The single-stage and three-stage amplifiers were installed in separate test fixtures and connected as shown in Figures 19 and 20, respectively. Each test fixture was located in an insulated container so that the ambient temperature could be stabilized at 298K, 353K and 408K. The following procedure was used to record output flow vs output pressure for constant supply pressure.

1. R1 was adjusted to 69 kilopascals (10 psig).
2. R2, R5, and R6 were adjusted, as applicable, to the pressure shown in Table III for $N_R$ = 85 at 353K.
3. The ambient temperature was stabilized at 298K.
4. R3 and R4 were adjusted for zero control pressure level.
5. A plot of output flow vs output pressure was made by varying valve V1 from full closed to full open.
6. Step 5 was repeated for control pressure levels of 5 percent and 10 percent of the supply pressure.
7. Steps 2, 4, 5, and 6 were repeated for ambient temperatures of 353K and 408K.
8. Steps 2 through 7 were repeated with the supply pressure initially adjusted to correspond to $N_R$ = 42.5 at 353K.

2.2.1.11 Power Jet Impedance - The single-stage amplifier was installed in a test fixture and connected as shown in Figure 21. The test fixture was located in an insulated container so that the ambient temperature could be stabilized at 298K, 353K, and 408K. The following procedure was used to record supply flow vs supply pressure.

1. R1 was adjusted to 69 kilopascals (10 psig).
2. The ambient temperature was stabilized at 298K.
3. Valve V1 was opened and a plot of supply flow vs supply pressure was made.
4. Step 3 was repeated for ambient temperatures of 353K and 408K.

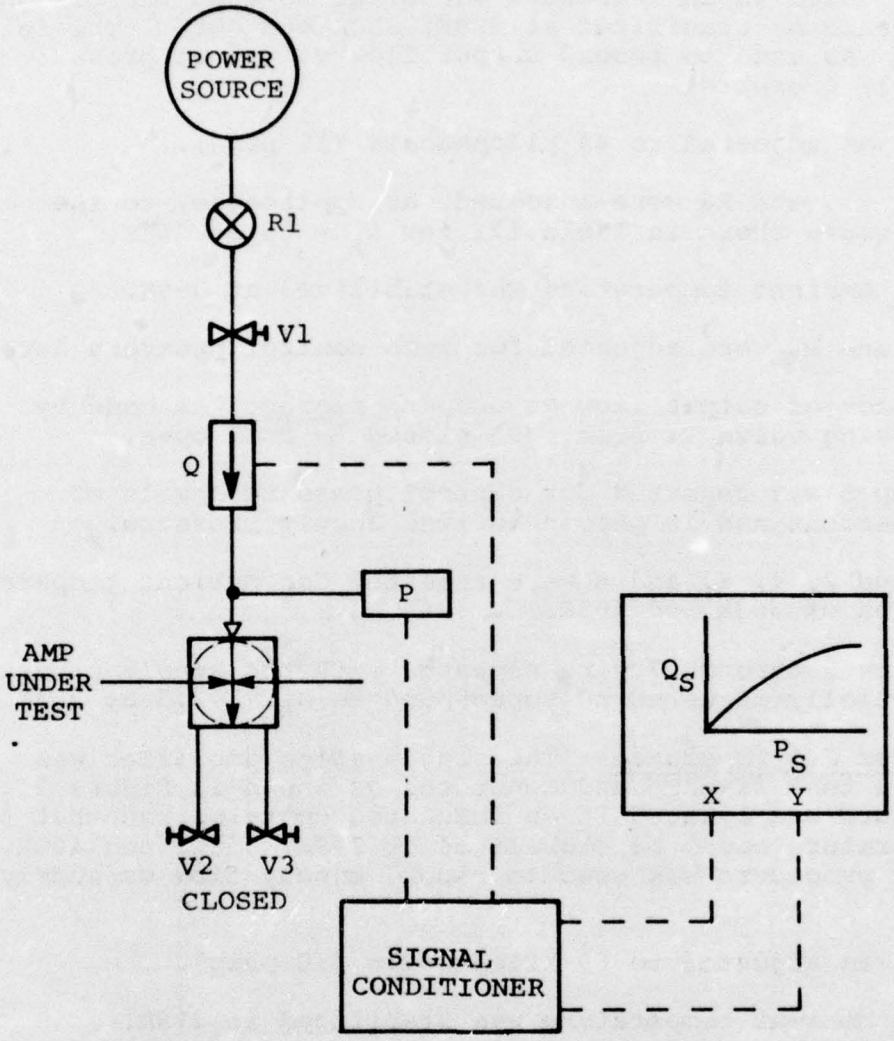



FIGURE 21

TEST SETUP, POWER JET IMPEDANCE

2.2.2 Hydraulic Tests

2.2.2.1 Pressure Gain - The single-stage and three-stage amplifiers were installed in separate test fixtures and connected as shown in Figures 10 and 11, respectively. The test stand used was capable of providing hydraulic fluid at the required pressures and temperatures. The following procedure was used to obtain a plot of differential output pressures vs differential control pressures.

1. Valves V1 and V2 were closed.

2. R1 was adjusted to 15,900 kilopascals (2300 psig).

3. R2, R5, and R6 were adjusted, as applicable, to the pressures shown in Table III for a supply temperature of 289K and a power jet Reynolds number of 85.

4. With R3 and R4 initially adjusted to zero gauge pressure, a plot of pressure gain ($\Delta P_{out}$ vs $\Delta P_{control}$) was made by increasing the control pressure on one side and returning to the initial value and then repeating for the other control pressure.

5. Step 4 was repeated with initial control pressure levels of 5 percent and 10 percent of the supply pressure.

6. Steps 3 through 5 were repeated for supply temperatures of 305K and 330K.

7. Steps 3 through 6 were repeated for $N_R$ = 42.5.

8. Steps 3 through 7 were repeated with valves V1 and V2 open.

2.2.2.2 Common Mode Rejection - The single-stage and three-stage amplifiers were installed in separate test fixtures and connected as shown in Figures 15 and 16, respectively. The test stand used was capable of providing hydraulic fluid at the required pressures and temperatures. The following procedure was used to record differential output pressure vs control pressure level so that the common mode rejection ratio may be determined.

1. Valves V1 and V2 were closed.

2. R1 was adjusted to 15,900 kilopascals (2300 psig).

3. R2, R5, and R6 were adjusted, as applicable, to the pressures shown in Table III for a supply temperature of 289K and $N_R$ = 85.

4. The control pressure level was increased from zero gauge pressure to 10 percent of the supply pressure and the differential output vs control pressure was plotted.

5. Steps 3 and 4 were repeated for supply temperatures of 305K and 330K.

6. Steps 3 through 5 were repeated for $N_R$ = 42.5

2.2.2.3 Input Impedance, Centered Jet - The single-stage amplifier was installed in a test fixture and connected as shown in Figure 22. The test stand used was capable of providing hydraulic fluid at the required pressures and temperatures. Due to flowmeter limitations for low flow rates, it was necessary to measure total control flow and to use several stages in parallel. The following procedure was used to record control flow vs control pressure level for constant power jet Reynolds number.

1. Valves V1 and V2 were closed.

2. R1 was adjusted to 15,900 kilopascals (2300 psig).

3. R2 was adjusted to the pressure shown in Table II for a supply temperature of 289K and $N_R$ = 85.

4. Control pressure was varied from 0 to 20 percent of supply pressure and a plot of control flow vs control pressure was made.

5. Steps 3 and 4 were repeated for supply temperatures of 350K and 330K.

6. Steps 3 through 5 were repeated for $N_R$ = 42.5.

7. Steps 3 through 6 were repeated with valves V1 and V2 open.

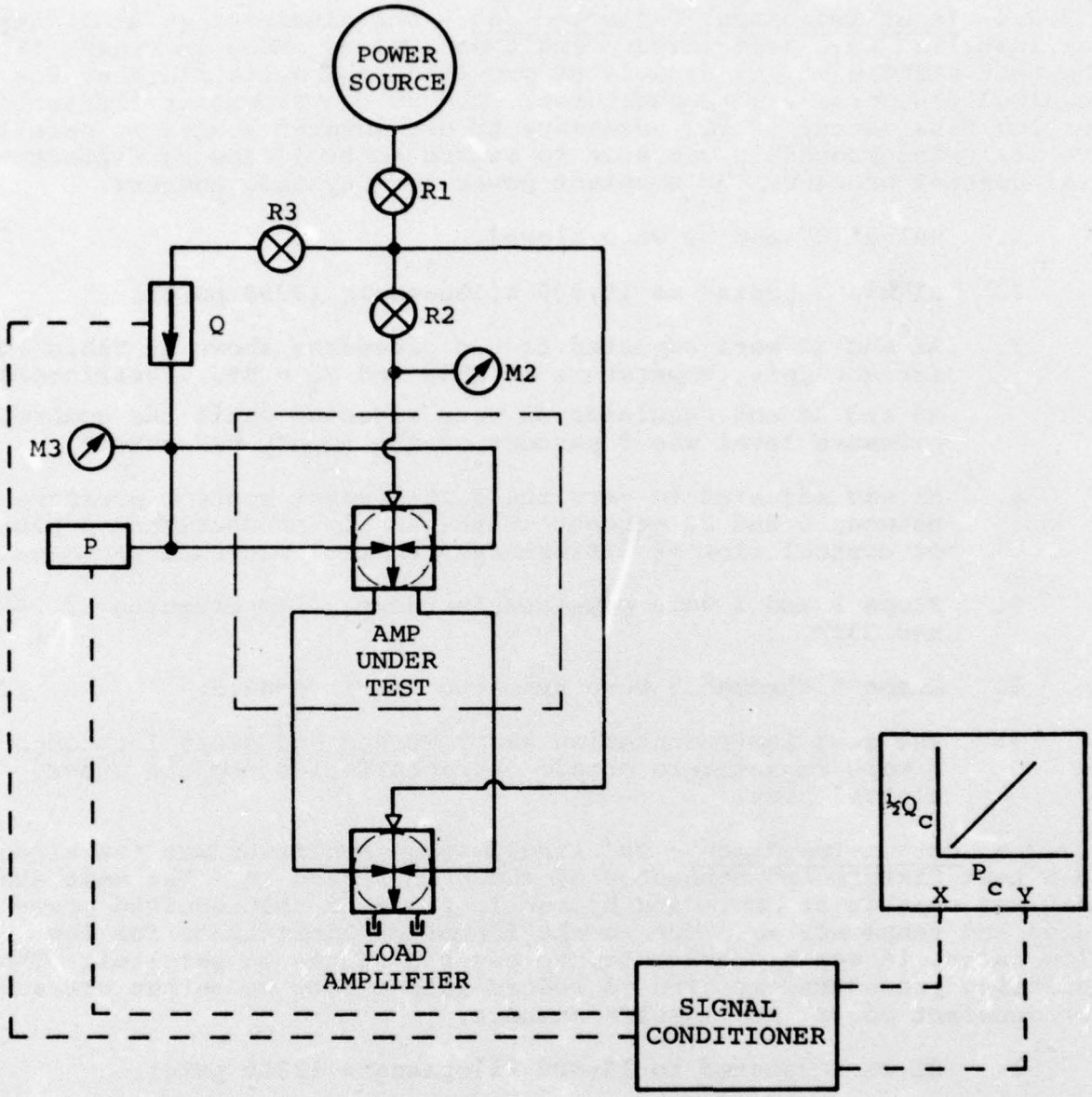



FIGURE 22

TEST SETUP, INPUT
IMPEDANCE, CENTERED JET, HYDRAULIC

2.2.2.4 Input Impedance, Deflected Jet - The single-stage amplifier was installed in a test fixture and connected as shown in Figure 18. The test stand used was capable of providing hydraulic fluid at the required pressures and temperatures. Due to the flowmeter limitations for low flow rates, it was necessary to use several stages in parallel. The following procedure was used to record control flow vs differential control pressure for constant power jet Reynolds numbers.

1. Valves V1 and V2 were closed.

2. R1 was adjusted to 15,900 kilopascals (2300 psig).

3. R2 and R4 were adjusted to the pressures shown in Table III for a supply temperature of 289K and $N_R$ = 85. Restrictors R5 and R6 and regulator R3 were adjusted until the control pressure level was 5 percent of the supply pressure.*

4. R3 was adjusted to vary the differential control pressure between 0 and 20 percent of the supply pressure and a plot of control flow vs differential control pressure was made.

5. Steps 3 and 4 were repeated for supply temperatures of 305K and 330K.

6. Steps 3 through 5 were repeated for $N_R$ = 42.5.

7. The test instrumentation was reversed and steps 1 through 6 were repeated to obtain characteristics for the other control port.

2.2.2.5 Output Impedance - The single-stage amplifier was installed in a test fixture and connected as shown in Figure 19. The test stand used was capable of providing hydraulic fluid at the required pressures and temperatures. Due to the flowmeter limitations for low flow rates, it was necessary to use several stages in parallel. The following procedure was used to record output flow vs output pressure for constant power jet Reynolds numbers.

1. R1 was adjusted to 15,900 kilopascals (2300 psig).

2. R2 was adjusted to the pressure shown in Table III for a supply temperature of 289K and $N_R$ = 85.

3. R3 and R4 were adjusted for zero control pressure level.

4. A plot of output flow versus output pressure was made by varying valve V1 from full closed to full open.

* This procedure does not allow constant control flow to be maintained on one control port.

5. Step 4 was repeated for control pressure levels of 5 percent and 10 percent of the supply pressure.

6. Steps 2 through 5 were repeated for supply temperatures of 305K and 330K.

7. Steps 2 through 6 were repeated for $N_R$ = 42.5.

2.2.2.6 Power Jet Impedance - The single-stage amplifier was installed in a test fixture and connected as shown in Figure 21. The test stand used was capable of providing hydraulic fluid at the required pressures and temperatures. The following procedure was used to record supply flow versus supply pressure.

1. R1 was adjusted to 15,900 kilopascals (2300 psig).

2. The supply temperature was stabilized at 289K.

3. Valve V1 was opened and a plot of supply flow versus supply pressure was made.

4. Step 3 was repeated for supply temperatures of 305K and 330K.

SECTION 3

TEST RESULTS

## 3.1 AIR TEST RESULTS

### 3.1.1 Pressure Gain, $N_R$ = Constant

Tables VII and VIII summarize the test results for pressure gain measurements on single-stage and three-stage amplifiers, respectively. Figures 23 through 32, included at the end of this section, present plots of gain versus control pressure level. Laboratory test data for all air tests are included in Appendix A.

### 3.1.2 Pressure Gain, $P_S$ = Constant

Tables IX and X summarize the test results for pressure gain measurements on the single-stage and three-stage amplifiers, respectively. Figures 33 and 34 present plots of gain versus temperature for the single-stage amplifiers. Figures 35 through 40 present plots of gain versus control pressure level for the three-stage amplifiers tested.

### 3.1.3 Pressure Gain, Vibration

Table XI summarizes the results of the vibration gain measurements. Oscilloscope observations during the vibration tests showed no increase in noise level throughout the frequency range of 5 to 1000 Hz. The gain variation noted for the Z-axis test may have been attributable to the test instrumentation. Regulated pressures to the test amplifier had to be adjusted as the frequency was increased in order to maintain constant conditions.

### 3.1.4 Common Mode Rejection

Common Mode Rejection Ratio (CMRR) was calculated at three control pressure levels using the following equation:

$$CMRR = G_p \frac{\partial P_c}{\partial P_o}$$

The term $G_p$ is the pressure gain ($\infty$ load) for the test amplifier and is given in Tables VII and VIII. The term $\partial P_c/\partial P_o$ was calculated at control pressure levels of 0 $P_s$, 0.05 $P_s$, and 0.10 $P_s$ using the test results given in Appendix 1 for output pressure differential versus control presure level. The values of CMRR calculated are summarized in Tables XII and XIII.



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TABLE VII

TEST RESULTS
SINGLE-STAGE AMPLIFIER GAIN
WITH $N_R$ CONSTANT

| $N_R$ = 85 | Amplifier 2.3.4.004 Temperature | | | Amplifier 2.3.1.004A Temperature | | |
|---|---|---|---|---|---|---|
| | 298K | 353K | 408K | 298K | 353K | 408K |
| | GAIN | | | | | |
| ∞ Load $P_c = 0\ P_s$ | 15.4 | 17.5 | 18.1 | 8.5 | 8.7 | 7.3 |
| ∞ Load $P_c = 0.05\ P_s$ | 4.3 | 4.6 | 4.6 | 6.1 | 6.2 | 5.5 |
| ∞ Load $P_c = 0.1\ P_s$ | 2.6 | 2.7 | 2.6 | 5.3 | 5.8 | 5.0 |
| Amp Load $P_c = 0\ P_s$ | 9.4 | 10.4 | 10.5 | 5.8 | 5.9 | 5.4 |
| Amp Load $P_c = 0.05\ P_s$ | 2.4 | 2.3 | 2.3 | 3.7 | 4.3 | 3.4 |
| Amp Load $P_c = 0.1\ P_s$ | 1.2 | 1.1 | 1.1 | 1.9 | 3.5 | 2.6 |
| $N_R$ = 42.5 | GAIN | | | | | |
| ∞ Load $P_c = 0\ P_s$ | 3.8 | 5.5 | 5.3 | 2.6 | 3.3 | 3.6 |
| ∞ Load $P_c = 0.05\ P_s$ | 1.7 | 2.2 | 2.2 | 2.2 | 2.7 | 2.7 |
| ∞ Load $P_c = 0.1\ P_s$ | 1.1 | 1.5 | 1.5 | 1.7 | 2.3 | 2.4 |
| Amp Load $P_c = 0\ P_s$ | 2.0 | 2.9 | 3.0 | 1.7 | 2.2 | 2.2 |
| Amp Load $P_c = 0.05\ P_s$ | 0.9 | 1.2 | 1.2 | 1.3 | 1.8 | 1.8 |
| Amp Load $P_c = 0.1\ P_s$ | 0.6 | 0.8 | 0.8 | 1.1 | 1.5 | 1.5 |

TABLE VIII

TEST RESULTS
THREE-STAGE AMPLIFIER GAIN
WITH $N_R$ CONSTANT

| $N_R$ = 85 | Assembly No. 1 Temperature | | | Assembly No. 2 Temperature | | | Assembly No. 3 Temperature | | |
|---|---|---|---|---|---|---|---|---|---|
| | 298K | 353K | 408K | 298K | 353K | 408K | 298K | 353K | 408K |
| | | | | GAIN | | | | | |
| ∞ Load $P_c = 0\ P_s$ | 503 | 538 | 605 | 519 | 588 | 607 | 403 | 420 | 445 |
| ∞ Load $P_c = 0.05\ P_s$ | 296 | 313 | 285 | 312 | 317 | 257 | 364 | 381 | 391 |
| ∞ Load $P_c = 0.1\ P_s$ | 221 | 234 | 230 | 228 | 233 | 217 | 332 | 344 | 368 |
| Amp Load $P_c = 0\ P_s$ | 152 | 159 | 181 | 22.5 | 21 | 21 | 111 | 101 | 100 |
| Amp Load $P_c = 0.05\ P_s$ | 79 | 92 | 79 | 12 | 12.5 | 11 | 103 | 93 | 92 |
| Amp Load $P_c = 0.1\ P_s$ | 56 | 61 | 61 | 9 | 10 | 9 | 97 | 85 | 83 |
| $N_R$ = 42.5 | | | | GAIN | | | | | |
| ∞ Load $P_c = 0\ P_s$ | 158 | 170 | 192 | 184 | 207 | 183 | 136 | 186 | 137 |
| ∞ Load $P_c = 0.05\ P_s$ | 96 | 113 | 94 | 148 | 146 | 131 | 119 | 154 | 128 |
| ∞ Load $P_c = 0.1\ P_s$ | 74 | 77 | 81 | 101 | 100 | 91 | 105 | 136 | 116 |
| Amp Load $P_c = 0\ P_s$ | 34 | 37 | 35 | 9 | 11.5 | 6 | 39 | 49 | 45 |
| Amp Load $P_c = 0.05\ P_s$ | 23 | 23 | 25 | 6 | 7 | 4.5 | 36 | 45 | 42 |
| Amp Load $P_c = 0.1\ P_s$ | 14 | 16 | 20 | 4 | 5 | 3.5 | 33 | 37 | 39 |

TABLE IX

TEST RESULTS
SINGLE-STAGE AMPLIFIER GAIN
WITH $P_s$ CONSTANT

| Amplifier | $P_s$ (kPa) | $P_c$ (kPa) | Load | Temperature 298K | 353K | 408K |
|---|---|---|---|---|---|---|
| 2.3.1.004A | 7.95 | 0.397 | ∞ | 5.8 | 5.5 | 5.2 |
| | 7.95 | 0.397 | 2.3.1.004A | 4.0 | 3.8 | 3.6 |
| | 1.98 | 0.099 | ∞ | 3.7 | 2.9 | 1.6 |
| | 1.98 | 0.099 | 2.3.1.004A | 2.5 | 1.6 | 1.0 |
| 2.3.4.004 | 7.95 | 0.397 | ∞ | 3.5 | 3.0 | 2.9 |
| | 7.95 | 0.397 | 2.3.4.004 | 1.8 | 1.6 | 1.5 |
| | 1.98 | 0.099 | ∞ | 3.7 | 1.6 | 1.1 |
| | 1.98 | 0.099 | 2.3.4.004 | 1.1 | 0.9 | 0.6 |

TABLE X

TEST RESULTS
THREE-STAGE AMPLIFIER GAIN
WITH $P_s$ CONSTANT

| $P_{s1}$ = 0.093 kPa<br>$P_{s2}$ = 0.34 kPa<br>$P_{s3}$ = 2.0 kPa | Assembly No. 1 Temperature | | | Assembly No. 2 Temperature | | | Assembly No. 3 Temperature | | |
|---|---|---|---|---|---|---|---|---|---|
| | 298K | 353K | 408K | 298K | 353K | 408K | 298K | 353K | 408K |
| | GAIN | | | | | | | | |
| ∞ Load<br>$P_c = 0\ P_s$ | 341 | 201 | 162 | 345 | 213 | 73 | 241 | 196 | 67 |
| ∞ Load<br>$P_c = 0.05\ P_s$ | 154 | 98 | 69 | 213 | 152 | 52 | 205 | 154 | 53 |
| ∞ Load<br>$P_c = 0.1\ P_s$ | 122 | 72 | 36 | 163 | 101 | 47 | 186 | 137 | 47 |
| Amp Load<br>$P_c = 0\ P_s$ | 86 | 43 | 29 | 16 | 11.4 | 2.6 | 126 | 48 | 17 |
| Amp Load<br>$P_c = 0.05\ P_s$ | 42 | 22 | 15 | 9.5 | 6.7 | 2.0 | 98 | 43 | 15.5 |
| Amp Load<br>$P_c = 0.1\ P_s$ | 35 | 17 | 9 | 6.5 | 5.0 | 1.8 | 87 | 37 | 13 |
| $P_{s1}$ = 037 kPa<br>$P_{s2}$ = 1.35 kPa<br>$P_{s3}$ = 7.9 kPa | GAIN | | | | | | | | |
| ∞ Load<br>$P_c = 0\ P_s$ | 690 | 558 | 483 | 438 | 515 | 518 | 502 | 418 | 374 |
| ∞ Load<br>$P_c = 0.05\ P_s$ | 326 | 308 | 267 | 304 | 336 | 290 | 448 | 374 | 345 |
| ∞ Load<br>$P_c = 0.1\ P_s$ | 172 | 235 | 175 | 202 | 233 | 247 | 376 | 345 | 289 |
| Amp Load<br>$P_c = 0\ P_s$ | 146 | 165 | 128 | 18 | 22 | 19 | 104 | 105 | 113 |
| Amp Load<br>$P_c = 0.05\ P_s$ | 75 | 96 | 79 | 13 | 12 | 12 | 83 | 93 | 110 |
| Amp Load<br>$P_c = 0.1\ P_s$ | 61 | 61 | 51 | 9 | 9.5 | 10 | 76 | 85 | 106 |

TABLE XI

VIBRATION GAIN TEST RESULTS

| Test Conditions | Amplifier 2.3.1.004A Axis | | | Amplifier 2.3.4.004 Axis | | |
|---|---|---|---|---|---|---|
| | X | Y | Z | X | Y | Z |
| $P_s$ = 5.15 kPa<br>T = 298K | 5.9 | 5.6 | 5.5 | 7.9 | 7.7 | 9.3 |
| $P_s$ = 1.26 kPa<br>T = 298K | 1.6 | 1.7 | 1.8 at 0g<br>1.4 at 10g<br>1.3 at 20g<br>(82 Hz) | 2.0 | 2.3 | 2.2 at 0g<br>1.6 at 10g<br>1.4 at 20g<br>(80 Hz) |
| Three-Stage Assembly No. 3 | | | | | | |
| $P_{s_1}$ = 0.24 kPa<br>$P_{s_2}$ = 0.89 kPa<br>$P_{s_3}$ = 5.2 kPa<br>T = 298K | 88 | 94 | 90 | | | |

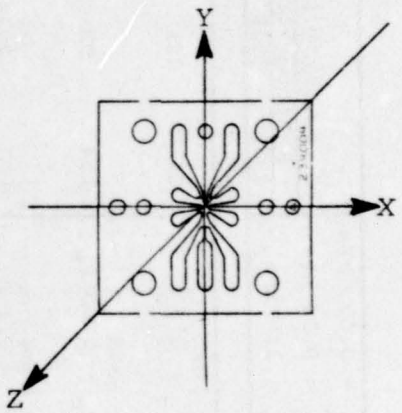


TABLE XII

SUMMARY OF COMMON MODE REJECTION RATIO
SINGLE-STAGE AMPLIFIER

| Amplifier | $N_R$ | Control Pressure Level | Common Mode Rejection Ratio | | |
|---|---|---|---|---|---|
| | | | 298K | 353K | 408K |
| 2.3.1.004A ∞ Load | 85 | 0 $P_s$ | 68.7 | 84.7 | 77.3 |
| | | 0.05 $P_s$ | 49.3 | 60.4 | 58.2 |
| | | 0.10 $P_s$ | 42.8 | 56.5 | 52.9 |
| | 42.5 | 0 $P_s$ | 404.6 | 307.5 | 141.3 |
| | | 0.05 $P_s$ | 288.8 | 207.3 | 81.6 |
| | | 0.10 $P_s$ | 160.3 | 113.8 | 65.6 |
| 2.3.4.004 ∞ Load | 85 | 0 $P_s$ | 78.4 | 97.1 | 236.5 |
| | | 0.05 $P_s$ | 66.6 | 47.7 | 60.1 |
| | | 0.10 $P_s$ | 25.5 | 45.9 | 34.0 |
| | 42.5 | 0 $P_s$ | 63.1 | 69.0 | 72.7 |
| | | 0.05 $P_s$ | 36.0 | 37.8 | 41.5 |
| | | 0.10 $P_s$ | 35.0 | 43.2 | 49.1 |

TABLE XIII

SUMMARY OF COMMON MODE REJECTION RATIO
THREE-STAGE AMPLIFIER

| Amplifier | $N_R$ | Control Pressure Level | Common Mode Rejection Ratio | | |
|---|---|---|---|---|---|
| | | | 298K | 353K | 408K |
| No. 1 ∞ Load | 85 | 0 $P_s$ | 101 | 13 | 58 |
| | | 0.05 $P_s$ | ∞ | ∞ | ∞ |
| | | 0.10 $P_s$ | ∞ | ∞ | ∞ |
| | 42.5 | 0 $P_s$ | 51 | 32 | 33 |
| | | 0.05 $P_s$ | 173 | 107 | 75 |
| | | 0.10 $P_s$ | 540 | 193 | 167 |
| No. 2 ∞ Load | 85 | 0 $P_s$ | 15 | 49 | 29 |
| | | 0.05 $P_s$ | 29 | 36 | 28 |
| | | 0.10 $P_s$ | 45 | 38 | 36 |
| | 42.5 | 0 $P_s$ | 26 | 20 | 17 |
| | | 0.05 $P_s$ | 51 | 19 | 12 |
| | | 0.10 $P_s$ | 105 | 90 | 69 |
| No. 3 ∞ Load | 85 | 0 $P_s$ | 34 | 37 | 33 |
| | | 0.05 $P_s$ | 44 | 39 | 42 |
| | | 0.10 $P_s$ | 59 | 64 | 65 |
| | 42.5 | 0 $P_s$ | 29 | 35 | 23 |
| | | 0.05 $P_s$ | 30 | 35 | 26 |
| | | 0.10 $P_s$ | 32 | 40 | 30 |

### 3.1.5 Input Impedance, Centered Jet, $N_R$ = Constant

Figures 41 through 44 present plots of input impedance versus temperature. The curves show input impedance for each control port and are identified as "INSTR #1" and "INSTR #2". Impedance was calculated from the slope of the control flow versus control pressure curve at the point where the control pressure level was five percent of the supply pressure.

### 3.1.6 Input Impedance, Centered Jet, $P_s$ = Constant

Figures 45 through 48 present plots of input impedance versus temperature. The curves show input impedance for each control port and are identified as "INSTR #1" and "INSTR #2". Impedance was calculated from the slope of the control flow versus control pressure curve at the point where the control pressure was five percent of the supply pressure.

### 3.1.7 Input Impedance, Deflected Jet, $N_R$ = Constant

Figures 49 and 50 present plots of input impedance versus temperature. The impedance was calculated from the slope of the control flow versus differential control pressure curve at $\Delta P_c = 0$.

### 3.1.8 Input Impedance, Deflected Jet, $P_s$ = Constant

Figures 51 through 54 present plots of input impedance versus temperature. The impedance was calculated by measuring the slope of the control flow versus differential control pressure curve at $\Delta P_c = 0$.

### 3.1.9 Output Impedance, $N_R$ = Constant

Figures 55 and 56 present plots of output impedance versus temperature. Note that total output flow is measured in the test setup; however, the data in Appendix 1 has been corrected to indicate single leg output flow. Output impedance was calculated from the slope of the output flow versus output pressure curve at the operating point shown on the data in Appendix 1.

### 3.1.10 Output Impedance, $P_s$ = Constant

Figures 57 and 58 present plots of output impedance versus temperature. Note that in the test setup, total output flow is measured; however, for calculating impedance, one-half the flow is used. Output impedance was calculated from the slope of the output flow versus output pressure curve at the operating point shown in the data in Appendix 1.

### 3.1.11 Power Jet Impedance

Figures 59 and 60 present plots of power jet impedance versus temperature. Impedance was calculated from the slope of the power jet flow versus pressure curve at the operating point shown on the data in Appendix A.

## 3.2 HYDRAULIC TEST RESULTS

### 3.2.1 Pressure Gain, $N_R$ = Constant

Tables XIV and XV summarize the test results for pressure gain measurements on single-stage and three-stage amplifiers, respectively. Test data for all hydraulic tests are included in Appendix B. Plots of gain versus control pressure level are presented in Figures 61 through 64 for the single-stage amplifiers and in Figures 65 through 70 for the three-stage amplifiers.

### 3.2.2 Common Mode Rejection Ratio

Common Mode Rejection Ratio (CMRR) was calculated at three control pressure levels using the following equation:

$$CMRR = G_p \frac{\partial P_c}{\partial P_o}$$

The term $G_p$ is the pressure gain ($\infty$ load) for the test amplifier and is given in Tables XIV and XV. The term $\partial P_c/\partial P_o$ was calculated at control pressure levels of 0 $P_s$, 0.05 $P_s$, and 0.10 $P_s$ using the test results contained in Appendix A for output pressure differential versus control pressure level. The values of CMRR calculated are summarized in Tables XVI and XVII.

### 3.2.3 Input Impedance, Centered Jet

Figures 71 through 82 present the results of control flow versus control pressure measurements for single-stage amplifiers (two laminations). These curves were generated from the test data included in Appendix A by applying the flowmeter calibration curve of Figure 7. Figures 83 and 84 present plots of input impedance versus temperature. The impedance was calculated from the slope of the control flow versus control pressure curve at a control pressure of five percent of the supply pressure.

### 3.2.4 Input Impedance, Deflected Jet

Figures 85 through 108 present the results of control flow versus differential control pressure measurements for single-stage amplifiers (two laminations). These curves were generated from the test data included in Appendix 1 by applying the flowmeter calibration curve of Figure 7. Figures 109 and 110 present plots of input impedance versus temperature. The impedance was calculated from the slope of the control flow versus differential control pressure curves in the vicinity of $\Delta P_c = 0$.

TABLE XIV

TEST RESULTS
SINGLE-STAGE AMPLIFIER GAIN

| | Amplifier 2.3.4.004 Temperature | | | Amplifier 2.3.1.004A Temperature | | |
|---|---|---|---|---|---|---|
| | 289K | 305K | 330K | 289K | 305K | 330K |
| $N_R$ = 85 | GAIN | | | | | |
| ∞ Load $P_C$ = 0 $P_S$ | 12.4 | 10.9 | 12.6 | 7.2 | 6.9 | 8.6 |
| ∞ Load $P_C$ = 0.05 $P_S$ | 8.4 | 7.3 | 8.6 | 7.2 | 6.9 | 8.2 |
| ∞ Load $P_C$ = 0.10 $P_S$ | 6.6 | 5.9 | 7.0 | 7.2 | 6.9 | 7.2 |
| Amp Load $P_C$ = 0 $P_S$ | 6.8 | 7.3 | 6.3 | 5.2 | 5.0 | 5.9 |
| Amp Load $P_C$ = 0.05 $P_S$ | 4.9 | 4.3 | 4.8 | 5.2 | 5.0 | 4.9 |
| Amp Load $P_C$ = 0.10 $P_S$ | 3.5 | 3.1 | 3.2 | 5.2 | 5.0 | 4.9 |
| $N_R$ = 42.5 | GAIN | | | | | |
| ∞ Load $P_C$ = 0 $P_S$ | 9.1 | 8.2 | 5.6 | 6.8 | 6.0 | 4.2 |
| ∞ Load $P_C$ = 0.05 $P_S$ | 6.0 | 6.0 | 4.2 | 6.2 | 6.0 | 4.2 |
| ∞ Load $P_C$ = 0.10 $P_S$ | 4.9 | 3.9 | 3.8 | 5.9 | 6.0 | 4.2 |
| Amp Load $P_C$ = 0 $P_S$ | 4.6 | 3.8 | 3.8 | 4.2 | 3.8 | 3.1 |
| Amp Load $P_C$ = 0.05 $P_S$ | 3.5 | 3.0 | 2.7 | 3.8 | 3.5 | 3.1 |
| Amp Load $P_C$ = 0.10 $P_S$ | 2.5 | 2.0 | 1.9 | 3.3 | 3.2 | 3.1 |

TABLE XV

TEST RESULTS
THREE-STAGE AMPLIFIER GAIN

| | Assembly No. 1 Temperature | | | Assembly No. 2 Temperature | | | Assembly No. 3 Temperature | | |
|---|---|---|---|---|---|---|---|---|---|
| | 289K | 305K | 330K | 289K | 305K | 330K | 289K | 305K | 330K |
| $N_R$ = 85 | GAIN | | | | | | | | |
| ∞ Load $P_c$ = 0 $P_s$ | 578 | 505 | 336 | 656 | 580 | 724 | 547 | 480 | 343 |
| ∞ Load $P_c$ = 0.05 $P_s$ | 341 | 281 | 205 | 315 | 286 | 268 | 436 | 371 | 327 |
| ∞ Load $P_c$ = 0.1 $P_s$ | 236 | 208 | 162 | 260 | 248 | 203 | 409 | 325 | 271 |
| Amp Load $P_c$ = 0 $P_s$ | 262 | 212 | 180 | 34 | 26 | 18.5 | 337 | 285 | 250 |
| Amp Load $P_c$ = 0.05 $P_s$ | 146 | 139 | 127 | 15 | 12 | 12.5 | 306 | 300 | 200 |
| Amp Load $P_c$ = 0.1 $P_s$ | 108 | 102 | 95 | 11 | 8.5 | 9 | 270 | 215 | 163 |
| $N_R$ = 42.5 | GAIN | | | | | | | | |
| ∞ Load $P_c$ = 0 $P_s$ | 236 | 240 | 226 | 385 | 300 | 155 | 221 | 213 | 187 |
| ∞ Load $P_c$ = 0.05 $P_s$ | 135 | 152 | 104 | 173 | 181 | 109 | 188 | 173 | 150 |
| ∞ Load $P_c$ = 0.1 $P_s$ | 102 | 114 | 82 | 99 | 134 | 96 | 169 | 160 | 119 |
| Amp Load $P_c$ = 0 $P_s$ | 86 | 74 | 65 | 24 | 15 | 9 | 110 | 116 | 75 |
| Amp Load $P_c$ = 0.05 $P_s$ | 53 | 55 | 27 | 12 | 10 | 5.5 | 91 | 107 | 69 |
| Amp Load $P_c$ = 0.1 $P_s$ | 38 | 41 | 19 | 9 | 8 | 4 | 79 | 85 | 58 |

TABLE XVI

SUMMARY OF COMMON MODE REJECTION RATIO
SINGLE-STAGE AMPLIFIER

| Amplifier | $N_R$ | Control Pressure Level | Common Mode Rejection Ratio Temperature 289K | 305K | 330K |
|---|---|---|---|---|---|
| 2.3.1.004A ∞ Load | 85 | 0 $P_s$ | 6 | ∞ | 6 |
| | | 0.05 $P_s$ | 225 | 140 | 123 |
| | | 0.10 $P_s$ | - | 136 | 6 |
| | 42.5 | 0 $P_s$ | ∞ | ∞ | ∞ |
| | | 0.05 $P_s$ | 79 | 356 | ∞ |
| | | 0.10 $P_s$ | 94 | 281 | 210 |
| 2.3.4.004 ∞ Load | 85 | 0 $P_s$ | 4 | 38 | 50 |
| | | 0.05 $P_s$ | 131 | 171 | 17 |
| | | 0.10 $P_s$ | 103 | 369 | 20 |
| | 42.5 | 0 $P_s$ | 221 | 138 | 10 |
| | | 0.05 $P_s$ | 45 | ∞ | 11 |
| | | 0.10 $P_s$ | 49 | 107 | 171 |

TABLE XVII

SUMMARY OF COMMON MODE REJECTION RATIO
THREE-STAGE AMPLIFIER

| Three-Stage Amplifier Assembly | $N_R$ | Control Pressure Level | Common Mode Rejection Ratio | | |
|---|---|---|---|---|---|
| | | | Temperature | | |
| | | | 289K | 305K | 330K |
| No. 1 ∞ Load | 85 | 0 $P_s$ | 122 | 463 | 7 |
| | | 0.05 $P_s$ | 27 | 119 | 101 |
| | | 0.10 $P_s$ | 412 | 129 | 33 |
| | 42.5 | 0 $P_s$ | 70 | 14 | 6.3 |
| | | 0.05 $P_s$ | 44 | 66 | 4.5 |
| | | 0.10 $P_s$ | 40 | 64 | 43 |
| No. 2 ∞ Load | 85 | 0 $P_s$ | 47 | 15 | 12 |
| | | 0.05 $P_s$ | 42 | 23 | 28 |
| | | 0.10 $P_s$ | 149 | 30 | 34 |
| | 42.5 | 0 $P_s$ | 229 | 116 | 6 |
| | | 0.05 $P_s$ | 49 | 31 | 10 |
| | | 0.10 $P_s$ | 59 | 46 | 13 |
| No. 3 ∞ Load | 85 | 0 $P_s$ | 7 | 64.3 | 11.3 |
| | | 0.05 $P_s$ | 22 | 928 | 49.1 |
| | | 0.10 $P_s$ | 28 | 86.5 | 32.5 |
| | 42.5 | 0 $P_s$ | 25 | 17.7 | 14 |
| | | 0.05 $P_s$ | 5 | 60.6 | 14 |
| | | 0.10 $P_s$ | 10.5 | 56 | 33.3 |

### 3.2.5 Output Impedance

Figures 111 through 122 present the results of output flow versus output pressure measurements for single-stage amplifiers (two laminations). The curves were generated from the test data included in Appendix A by applying the flowmeter calibration curve of Figure 7. Figures 123 and 124 present plots of output impedance versus temperature. The impedance was calculated from the slope of the output flow versus pressure curve at the point indicated on the curves. Due to the non-linearity of the curves and scatter in the flow data, it is recommended that the reader refer to Figures 111 through 122 for additional information on output impedance.

### 3.2.6 Power Jet Impedance

Figures 125 and 126 present the results of supply flow versus supply pressure measurements. The curves were generated from test data included in Appendix A by applying the flowmeter calibration curve of Figure 7. Figure 127 presents a plot of power jet impedance versus temperature. The impedance was calculated from the slope of the supply pressure versus supply flow curves at the point where the supply pressure corresponds to a power jet Reynolds number of 85.

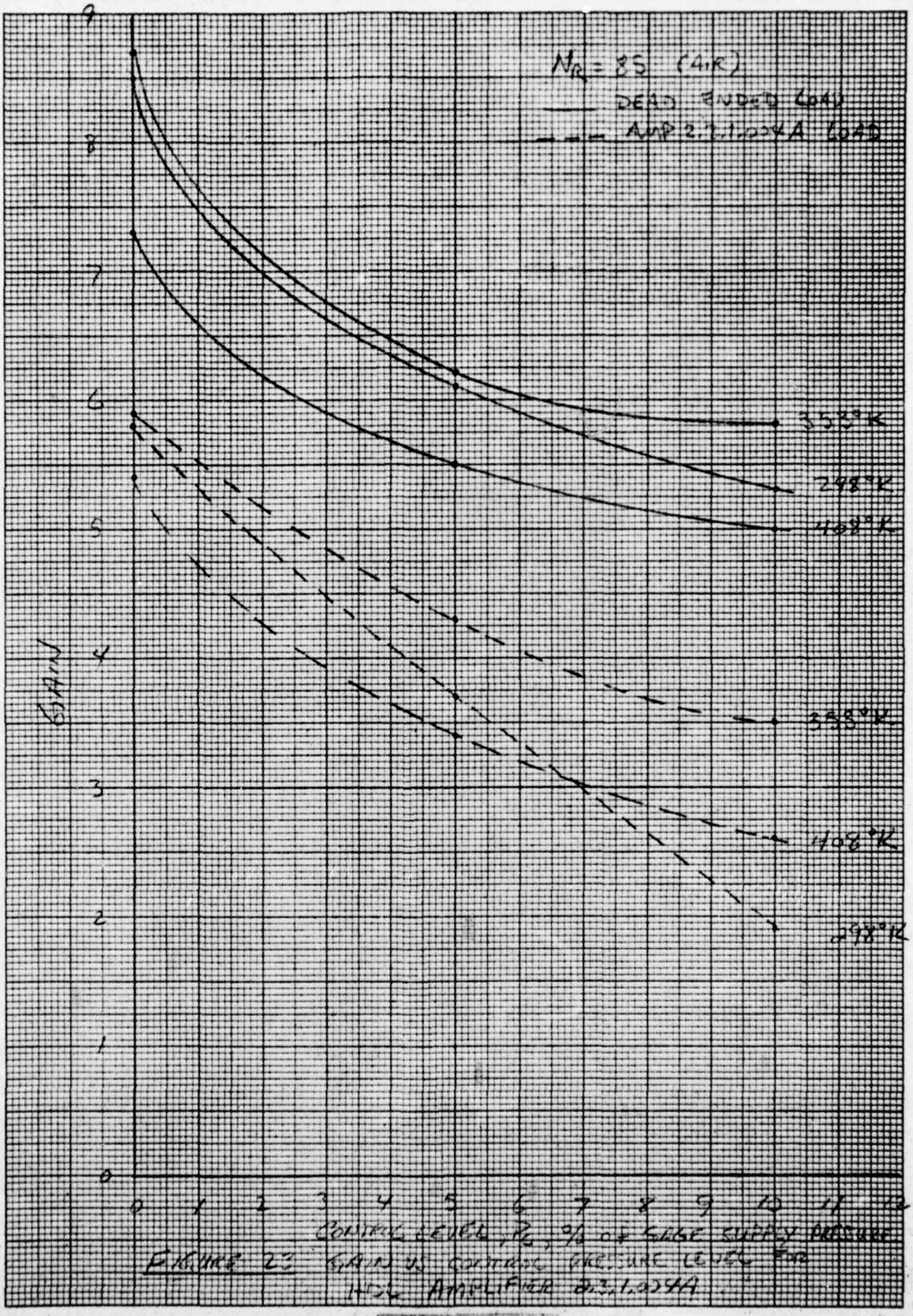



FIGURE 23 GAIN VS COUPLING PRESSURE LEVEL FOR HIGH AMPLIFIER 2.2.1.0054A

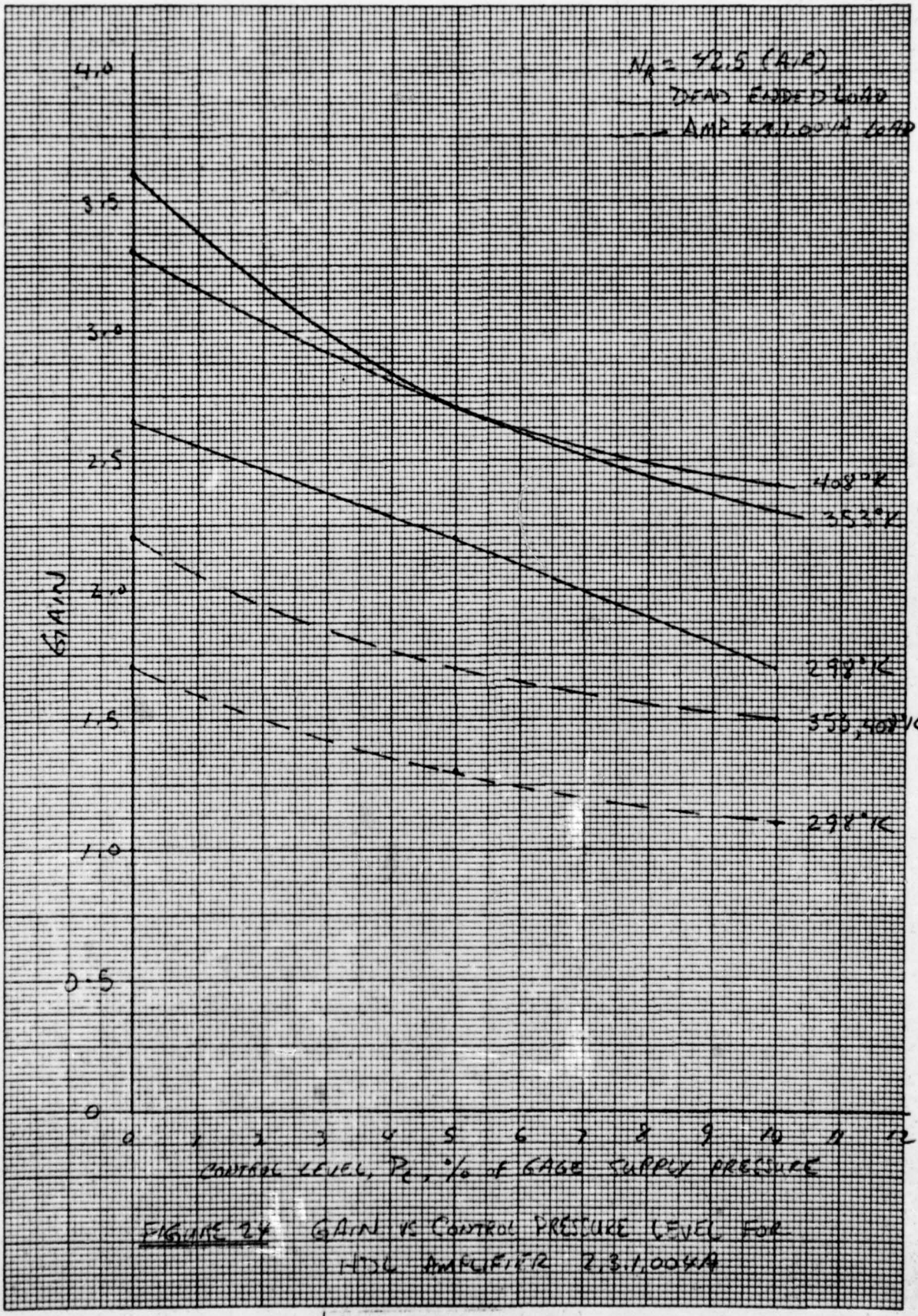



FIGURE 24 GAIN VS CONTROL PRESSURE LEVEL FOR HIGH AMPLIFIER 2.3.1.004A

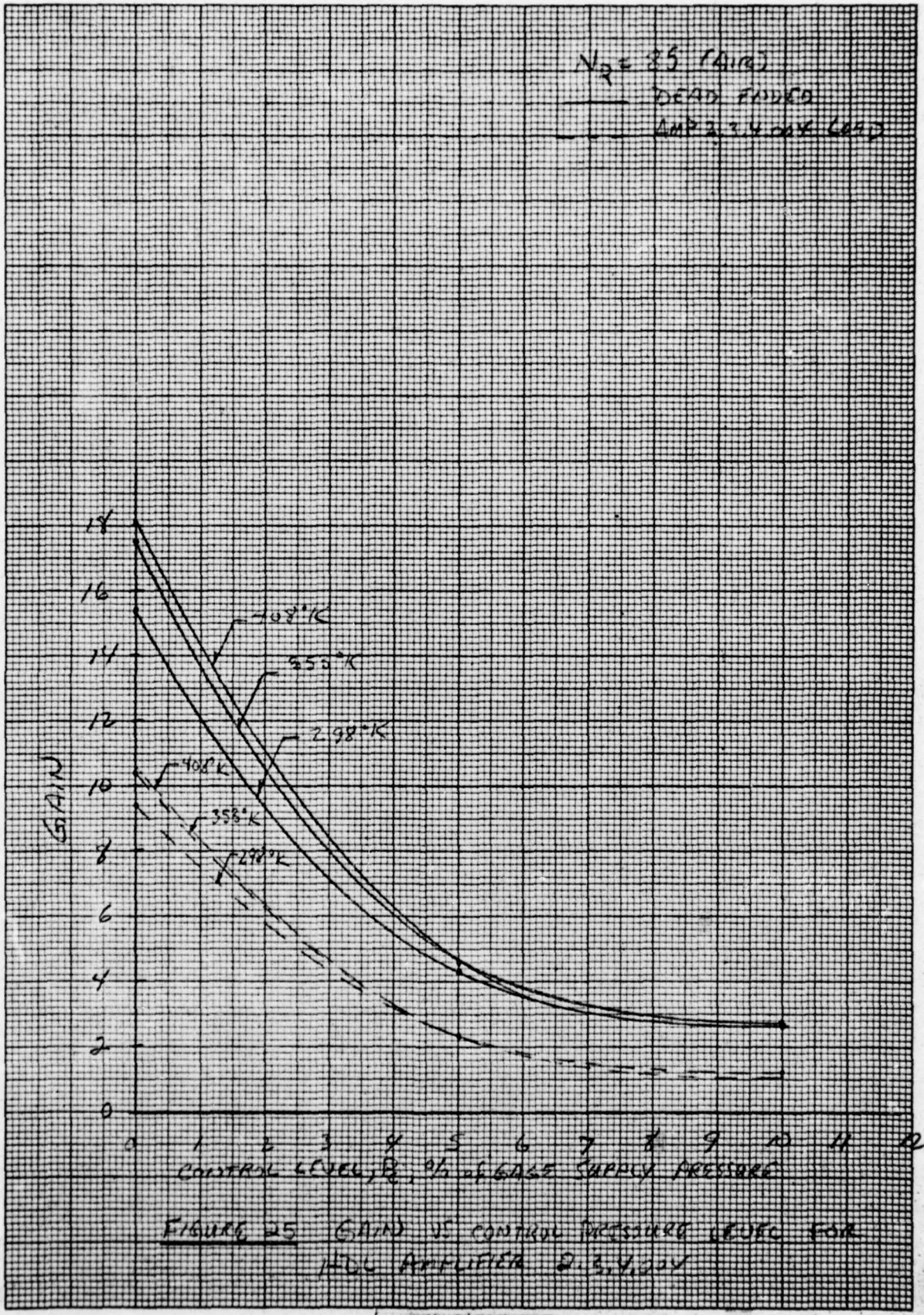



FIGURE 25 GAIN VS CONTROL PRESSURE CURVE FOR HEAT AMPLIFIER 2, 3, 4 ON

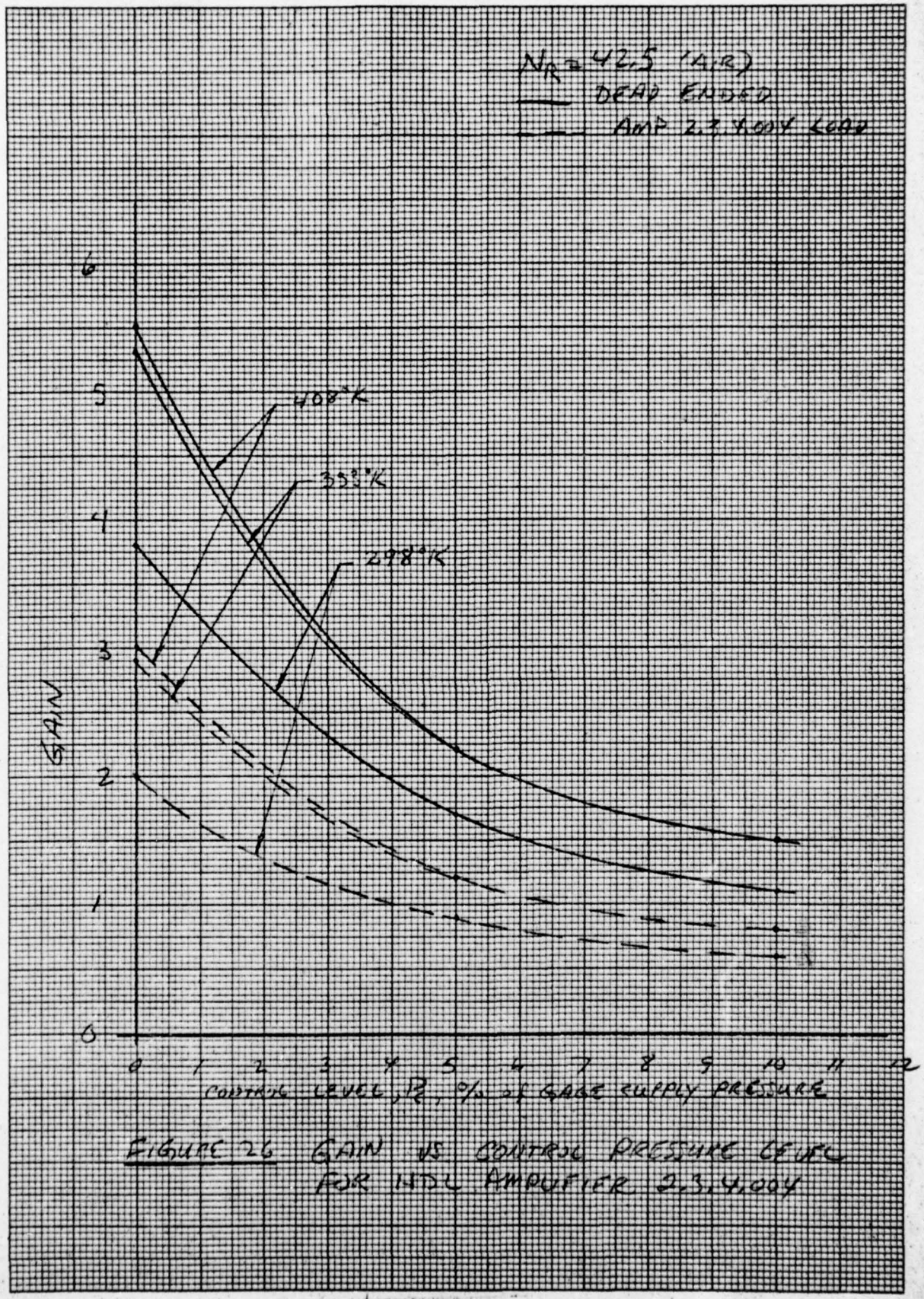



FIGURE 26 GAIN VS CONTROL PRESSURE OF JFC FOR INDY AMPLIFIER 2,3,4,00Y

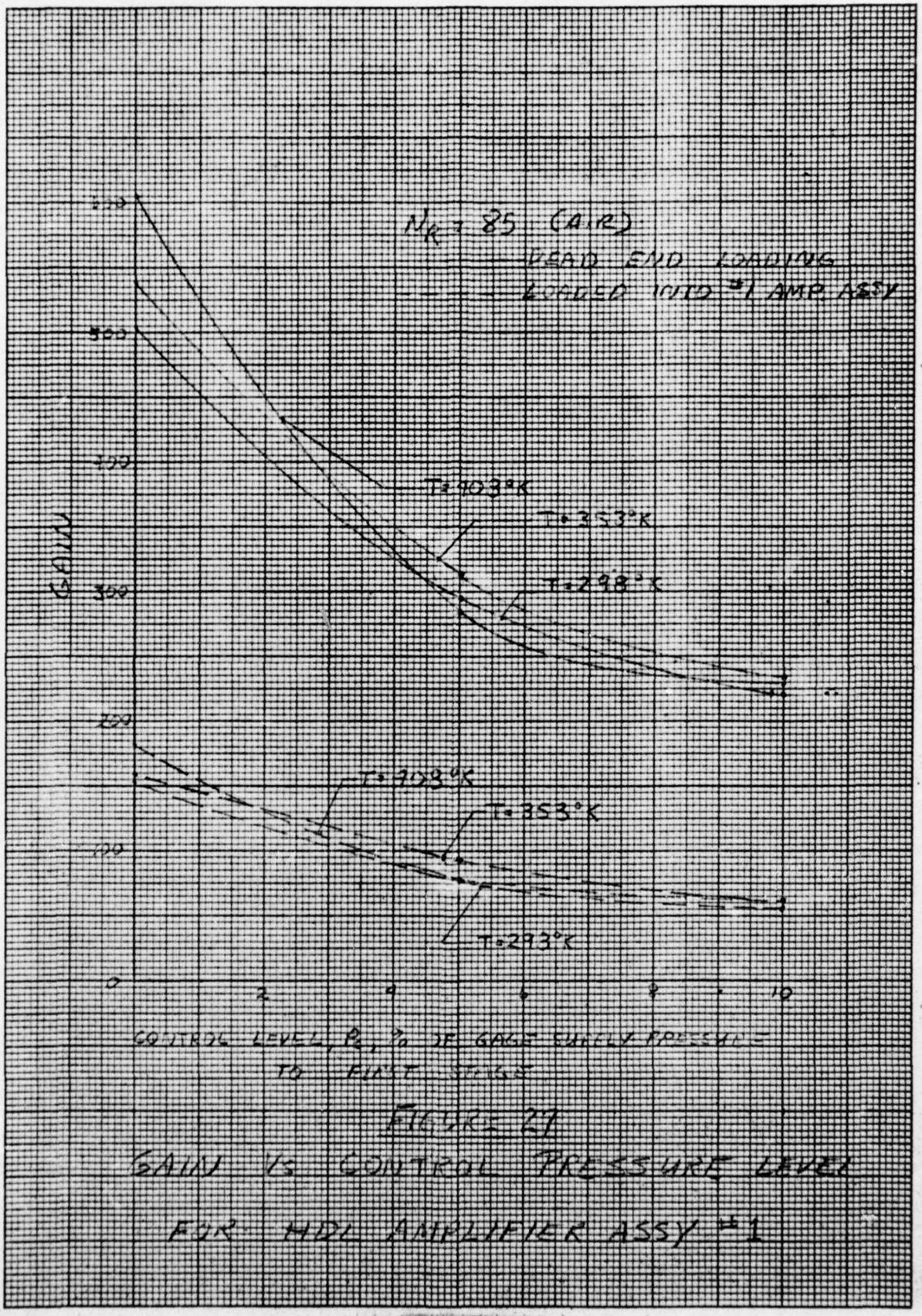



FIGURE 27

GAIN VS CONTROL PRESSURE LEVEL

FOR HDL AMPLIFIER ASSY #1

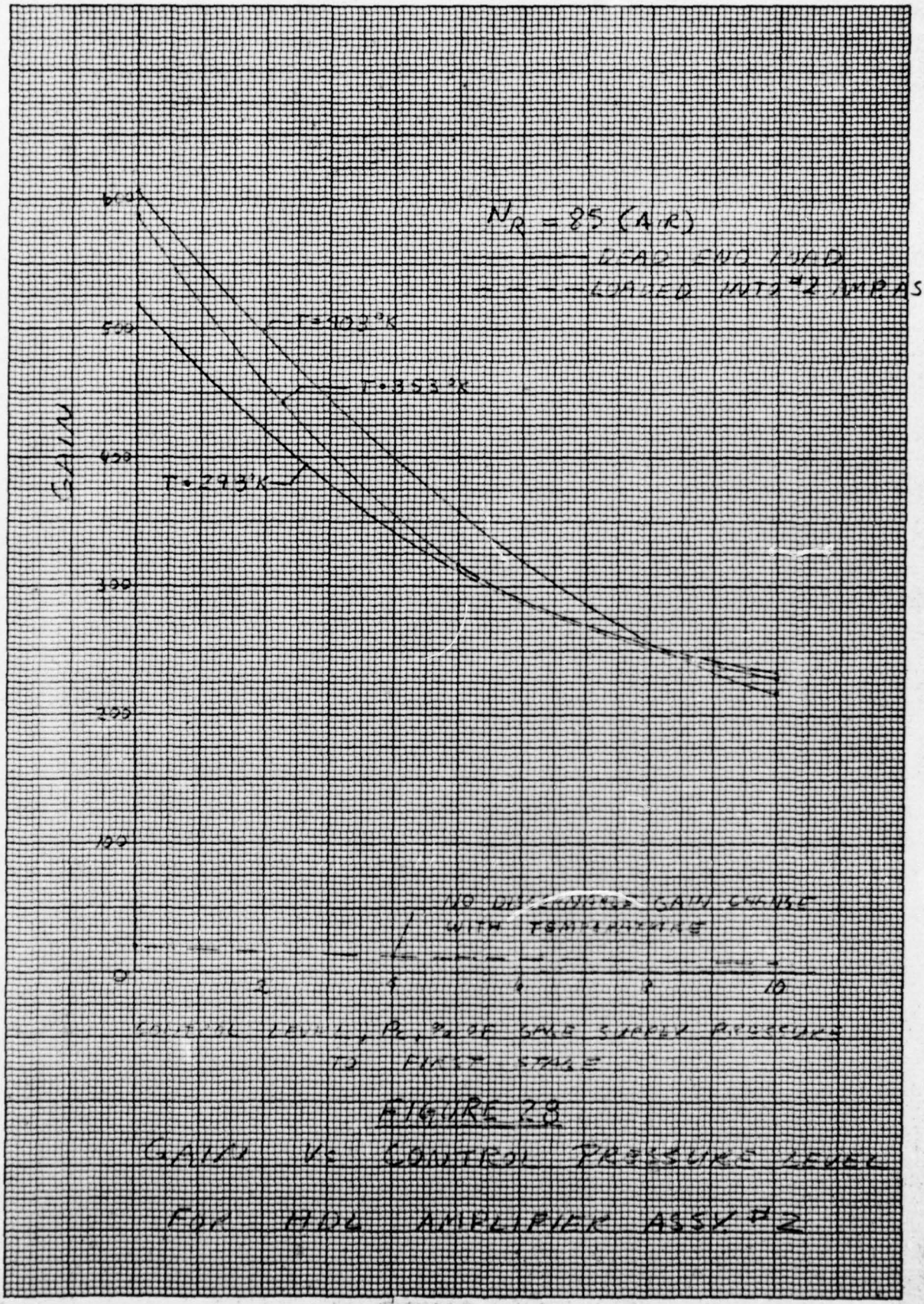



FIGURE 28

GAIN VS CONTROL PRESSURE LEVEL

FOR HDL AMPLIFIER ASSY #2

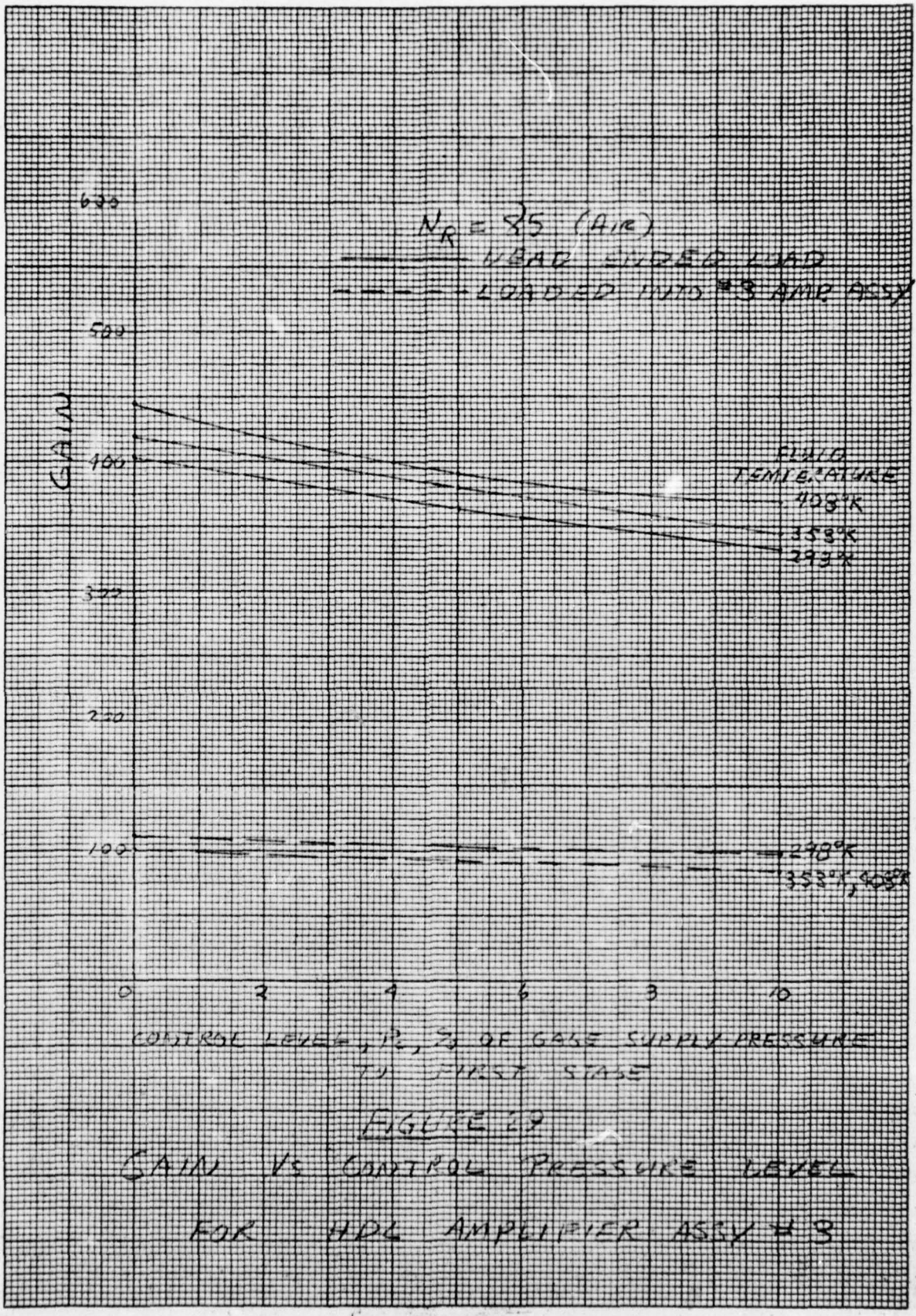



FIGURE 29

GAIN VS CONTROL PRESSURE LEVEL

FOR HDL AMPLIFIER ASSY #3

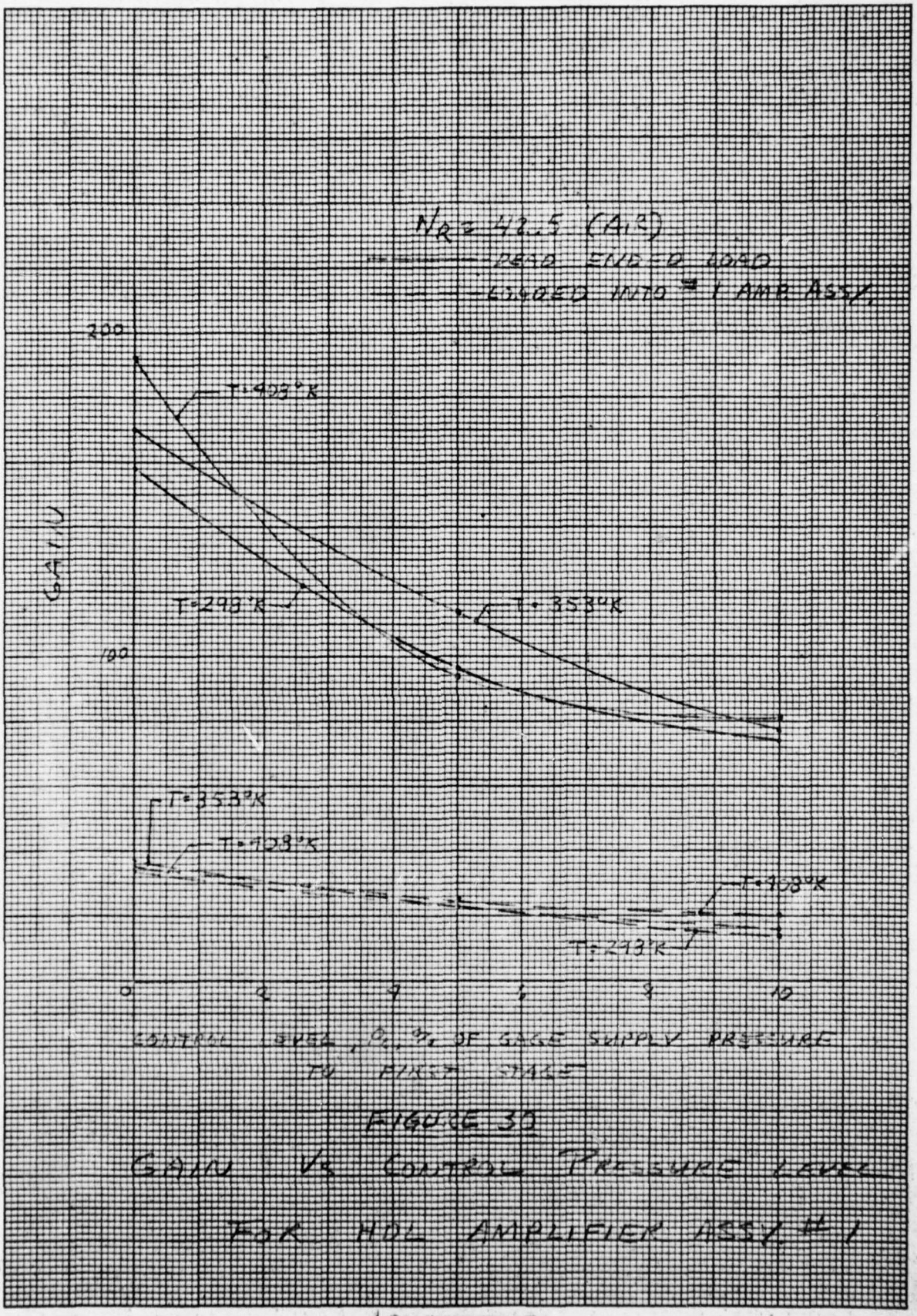



FIGURE 30

GAIN VS CONTROL PRESSURE LEVEL

FOR HDL AMPLIFIER ASSY. # 1

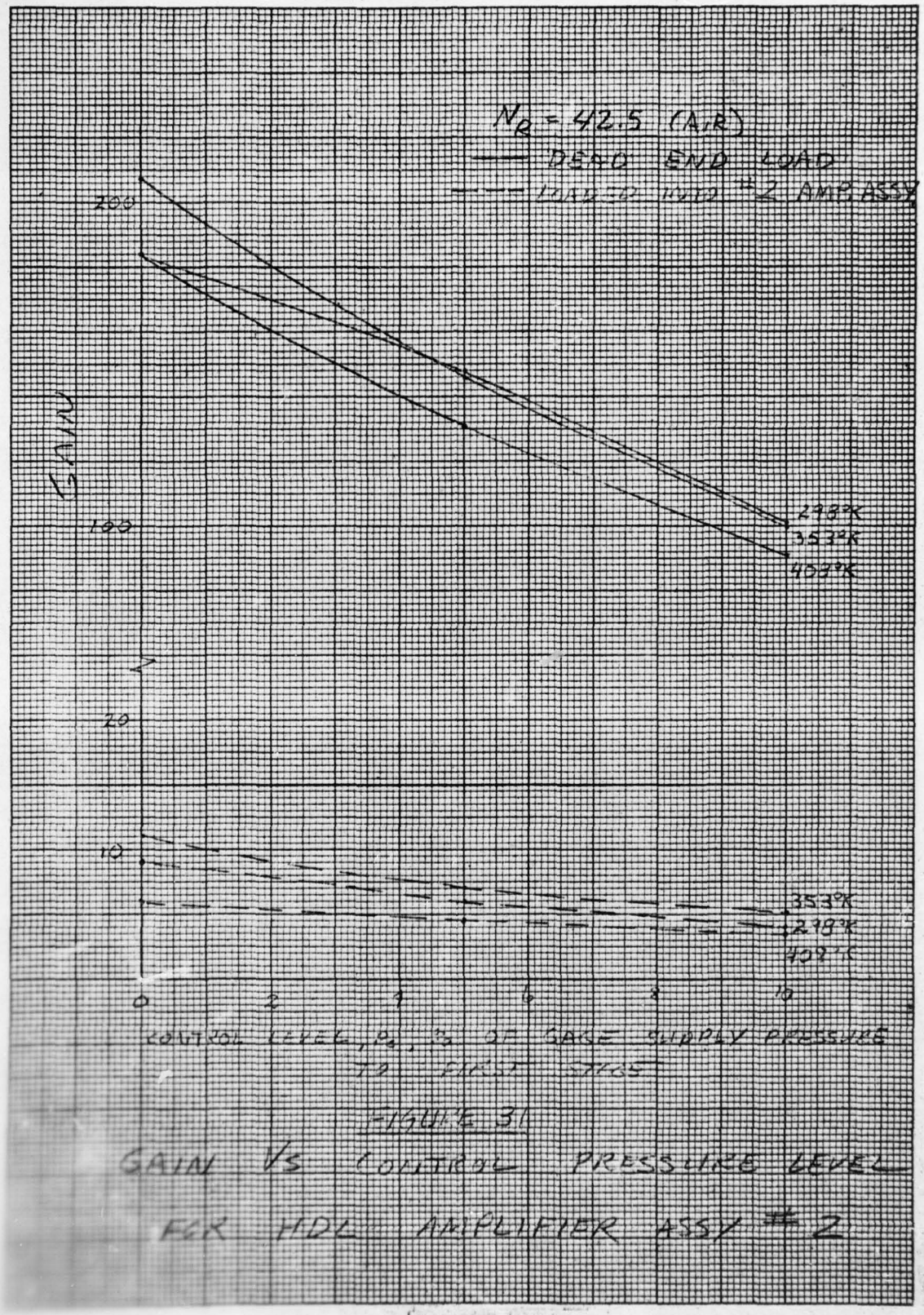



FIGURE 31

GAIN VS CONTROL PRESSURE LEVEL FOR HDL AMPLIFIER ASSY # 2

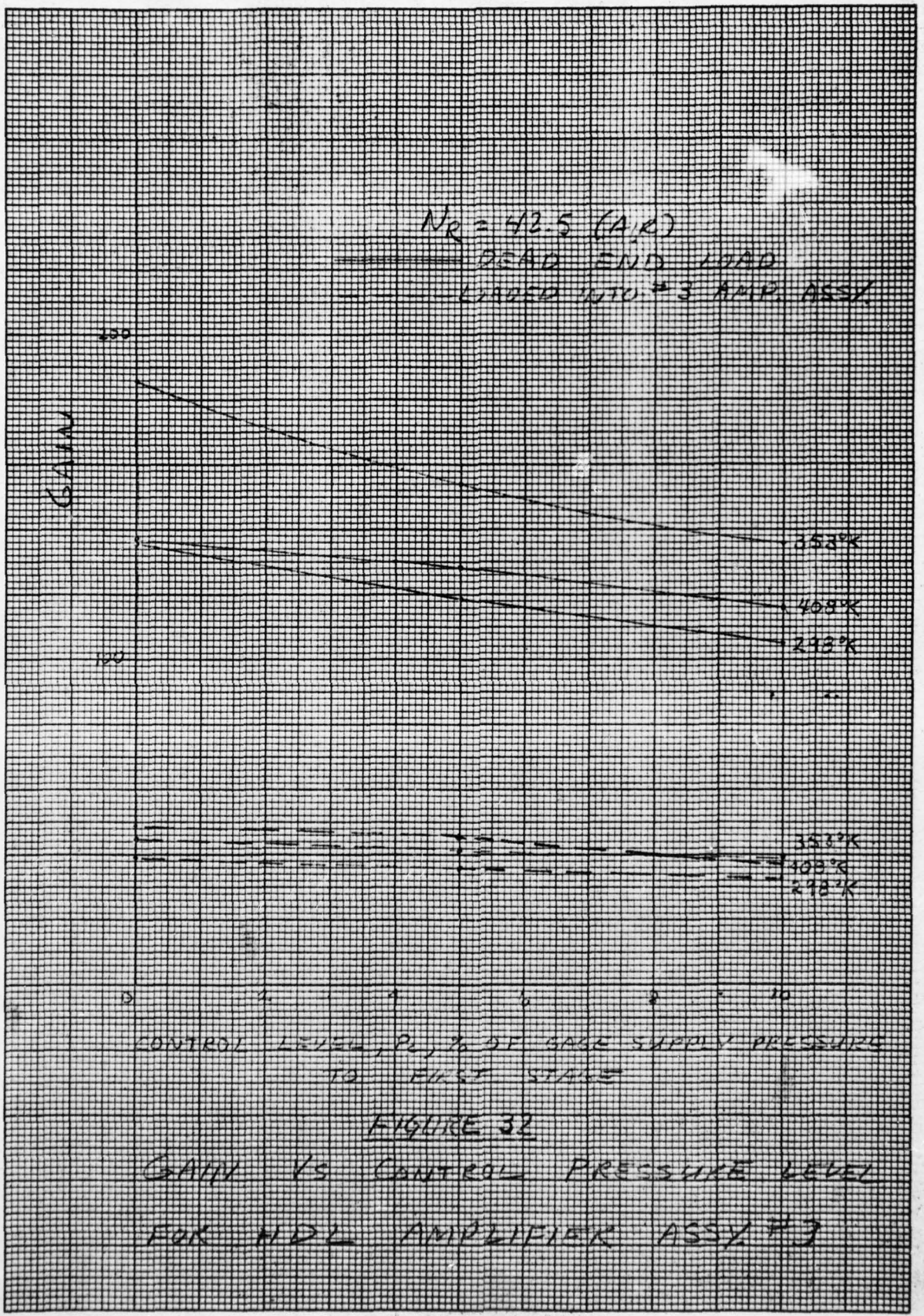



FIGURE 32

GAIN VS CONTROL PRESSURE LEVEL FOR HDL AMPLIFIER ASSY. #3

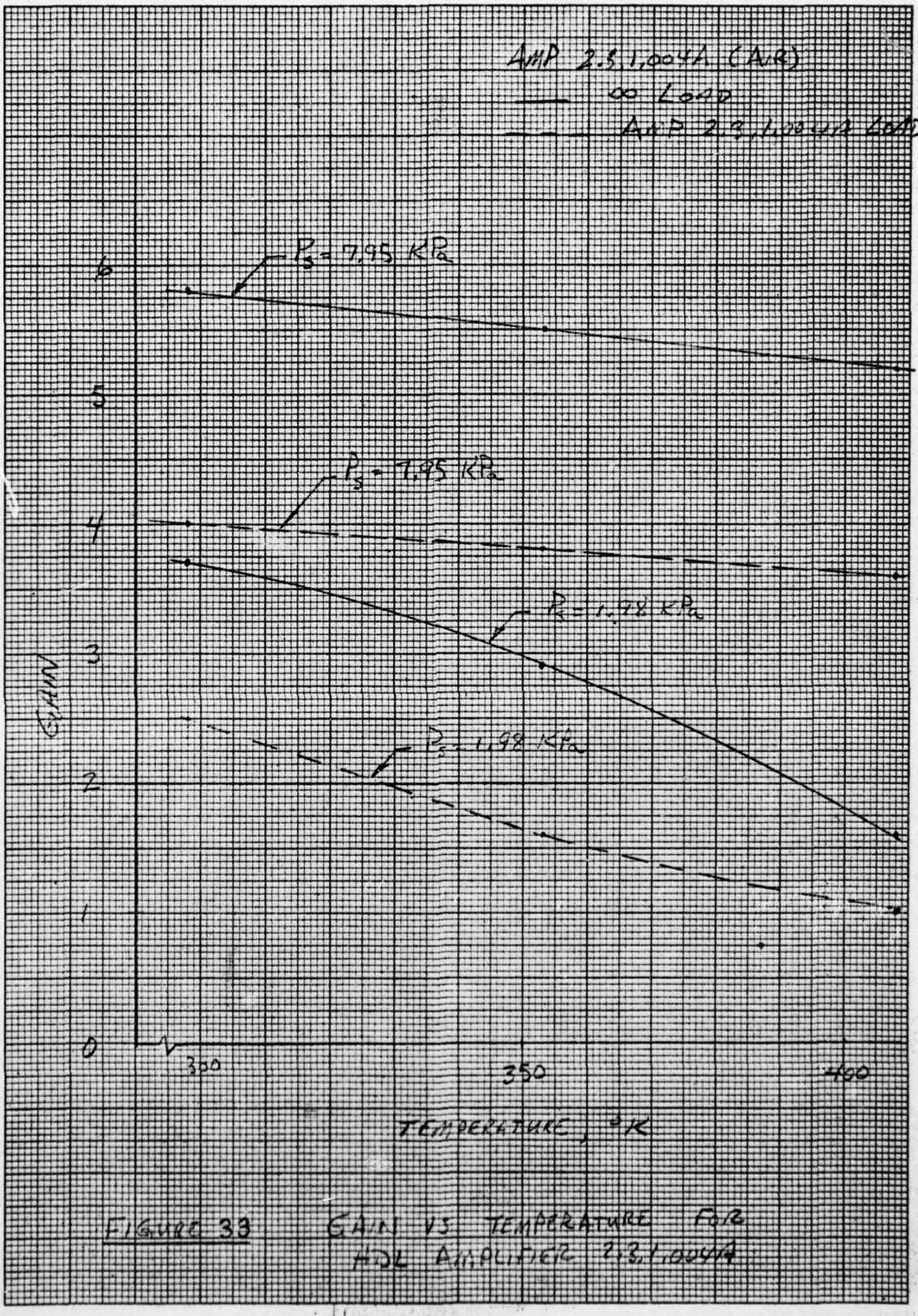



FIGURE 33 GAIN VS TEMPERATURE FOR HDL AMPLIFIER 2.3, 1.004A

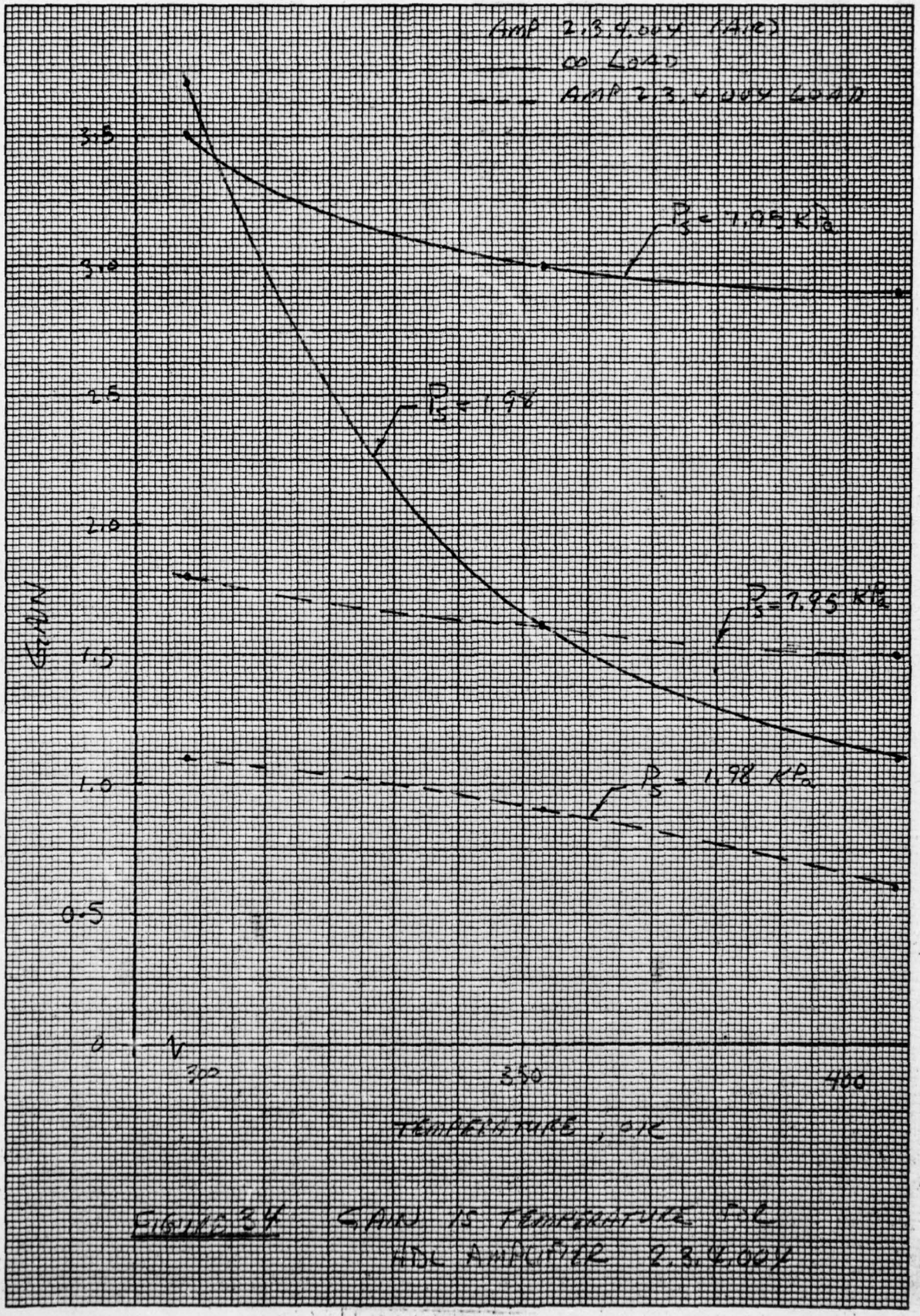



FIGURE 34 GAIN VS TEMPERATURE F.L HDL AMPLIFIER 2.3.4.00Y

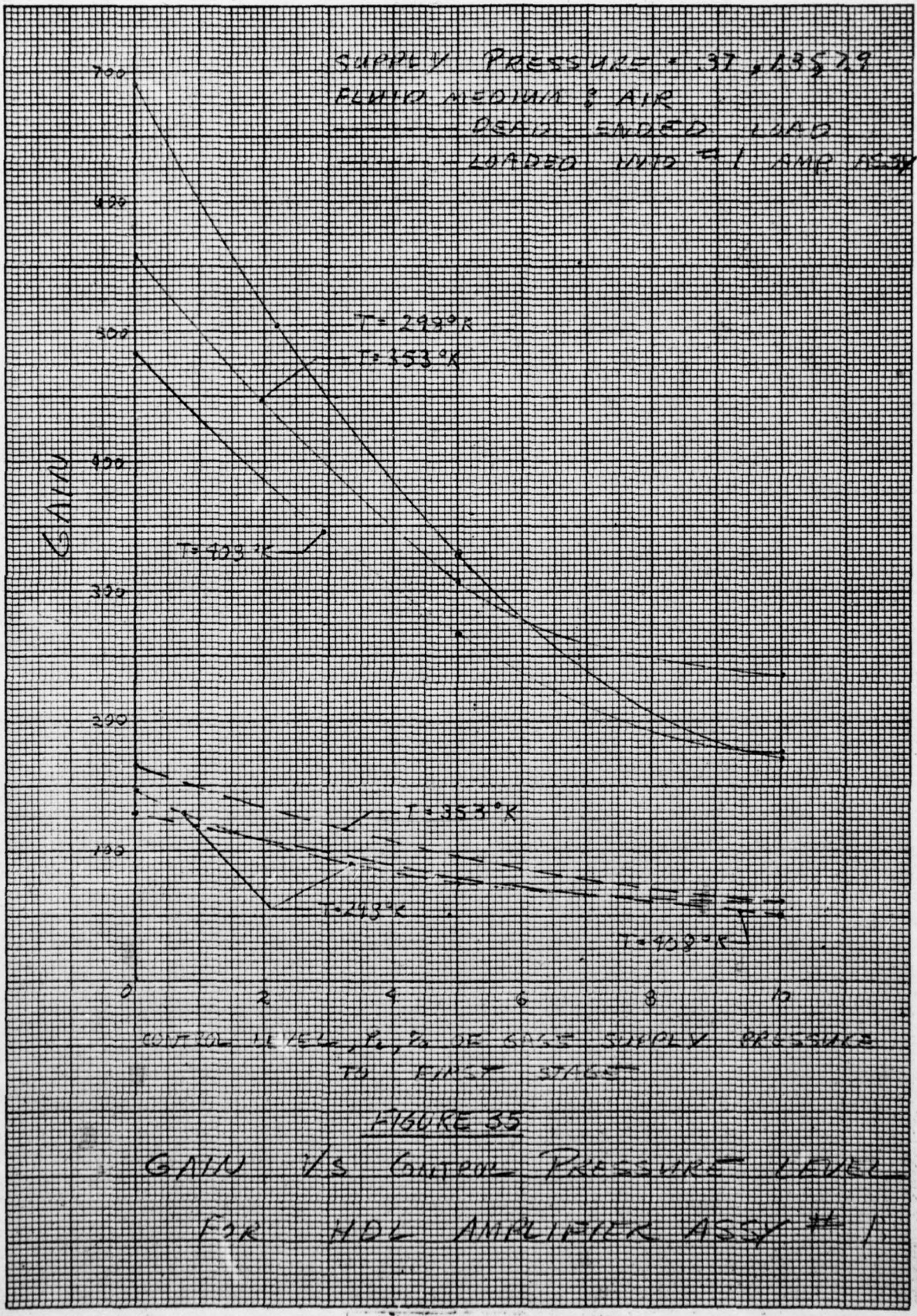



FIGURE 35

GAIN V/S CONTROL PRESSURE LEVEL FOR HDL AMPLIFIER ASSY # 1

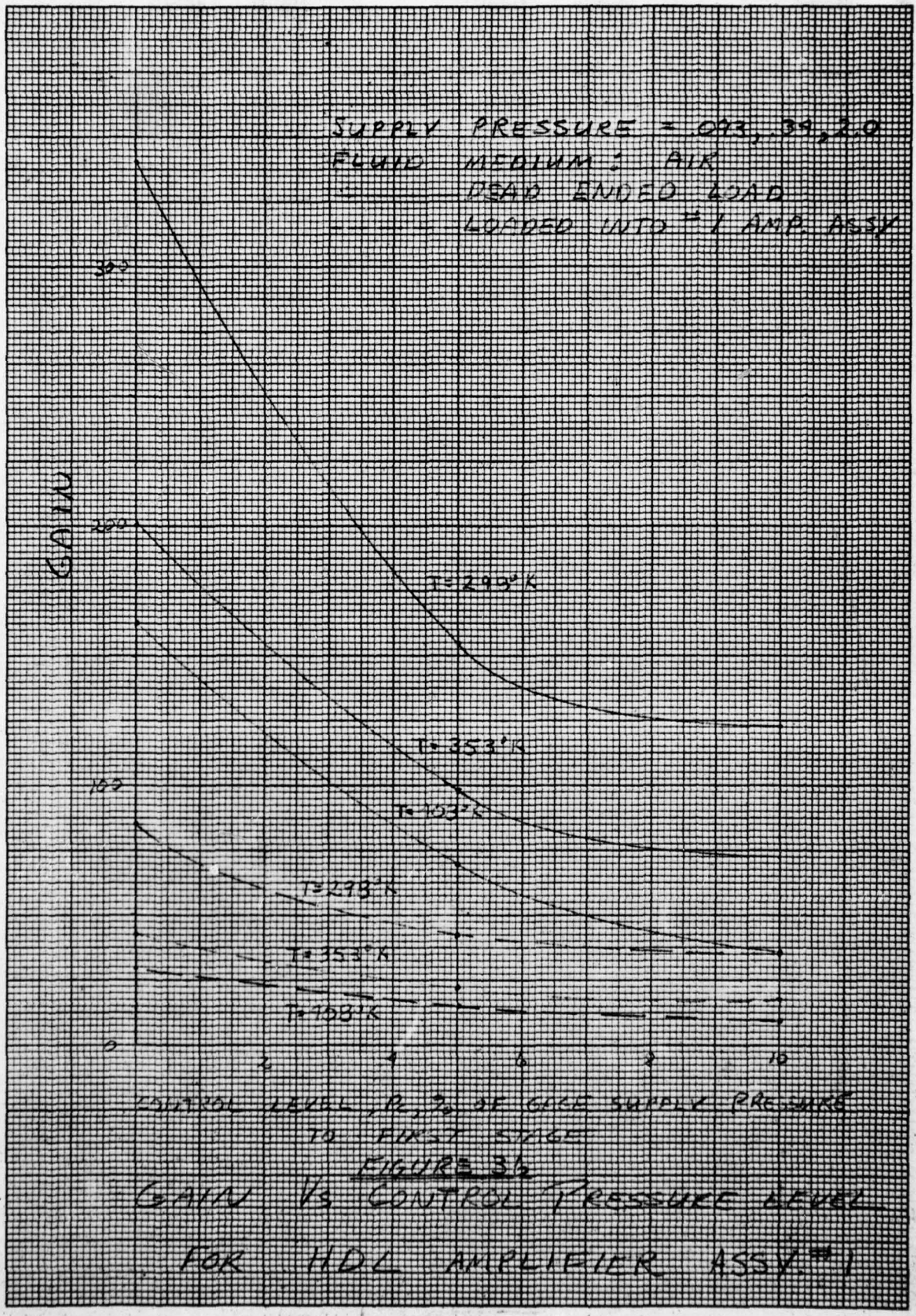



FIGURE 3b

GAIN Vs CONTROL PRESSURE LEVEL FOR HDL AMPLIFIER ASSY. #1

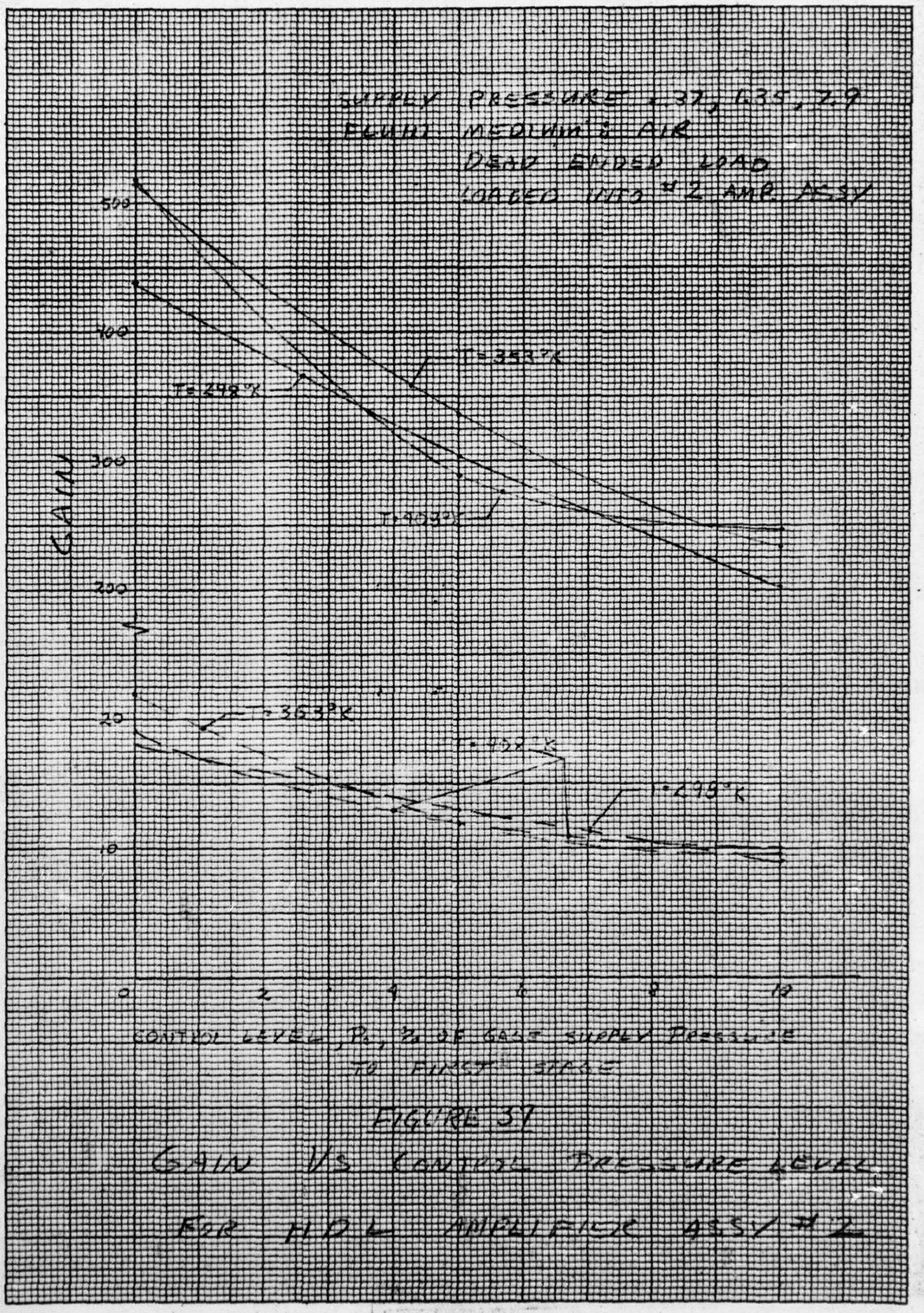



FIGURE 37

GAIN VS CONTROL PRESSURE LEVEL FOR HDL AMPLIFIER ASSY #2

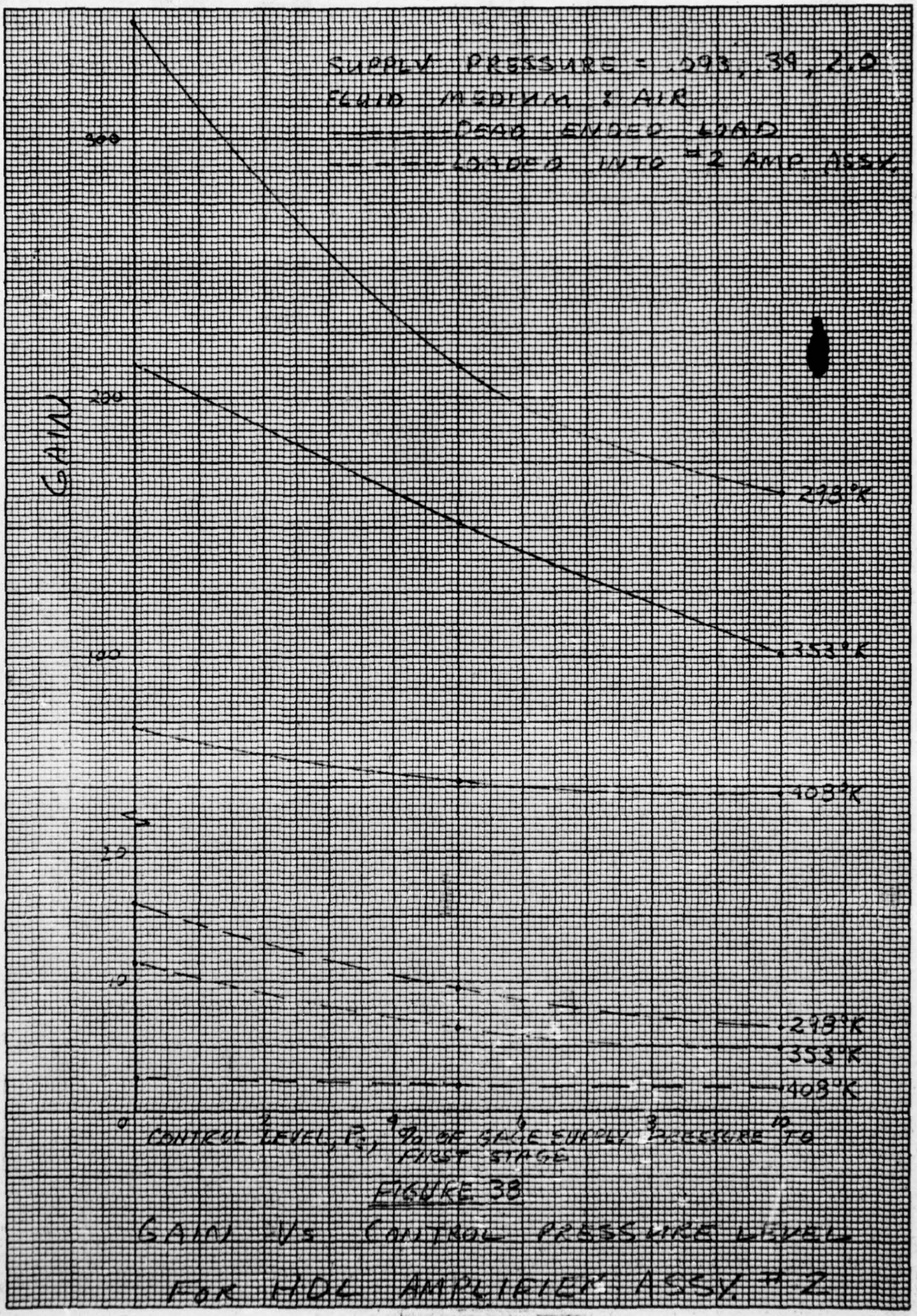



FIGURE 38

GAIN -Vs- CONTROL PRESSURE LEVELS

FOR HDL AMPLIFIER ASSY. # 2

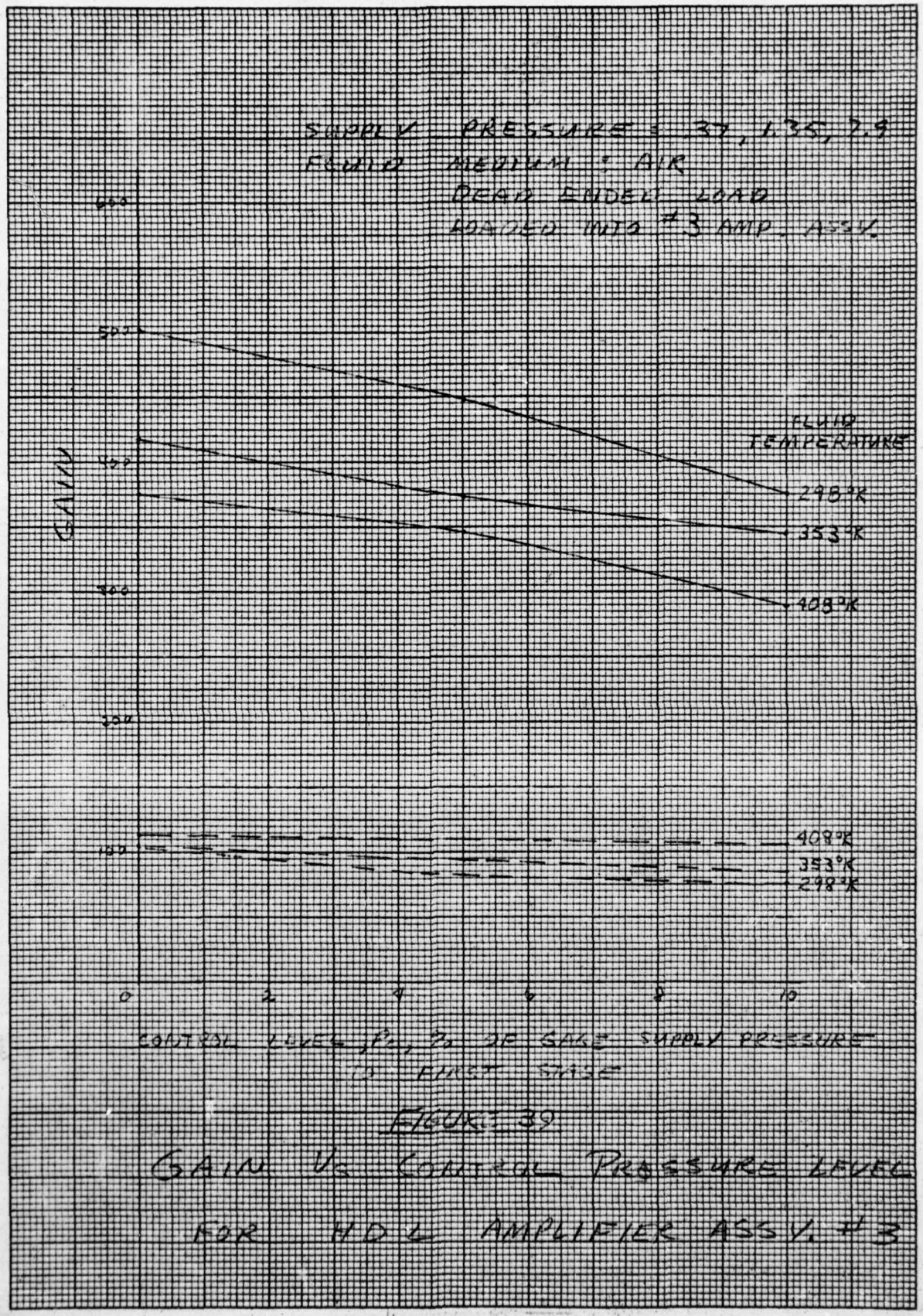



FIGURE 39

GAIN Vs CONTROL PRESSURE LEVEL

FOR HDL AMPLIFIER ASS'Y. #3

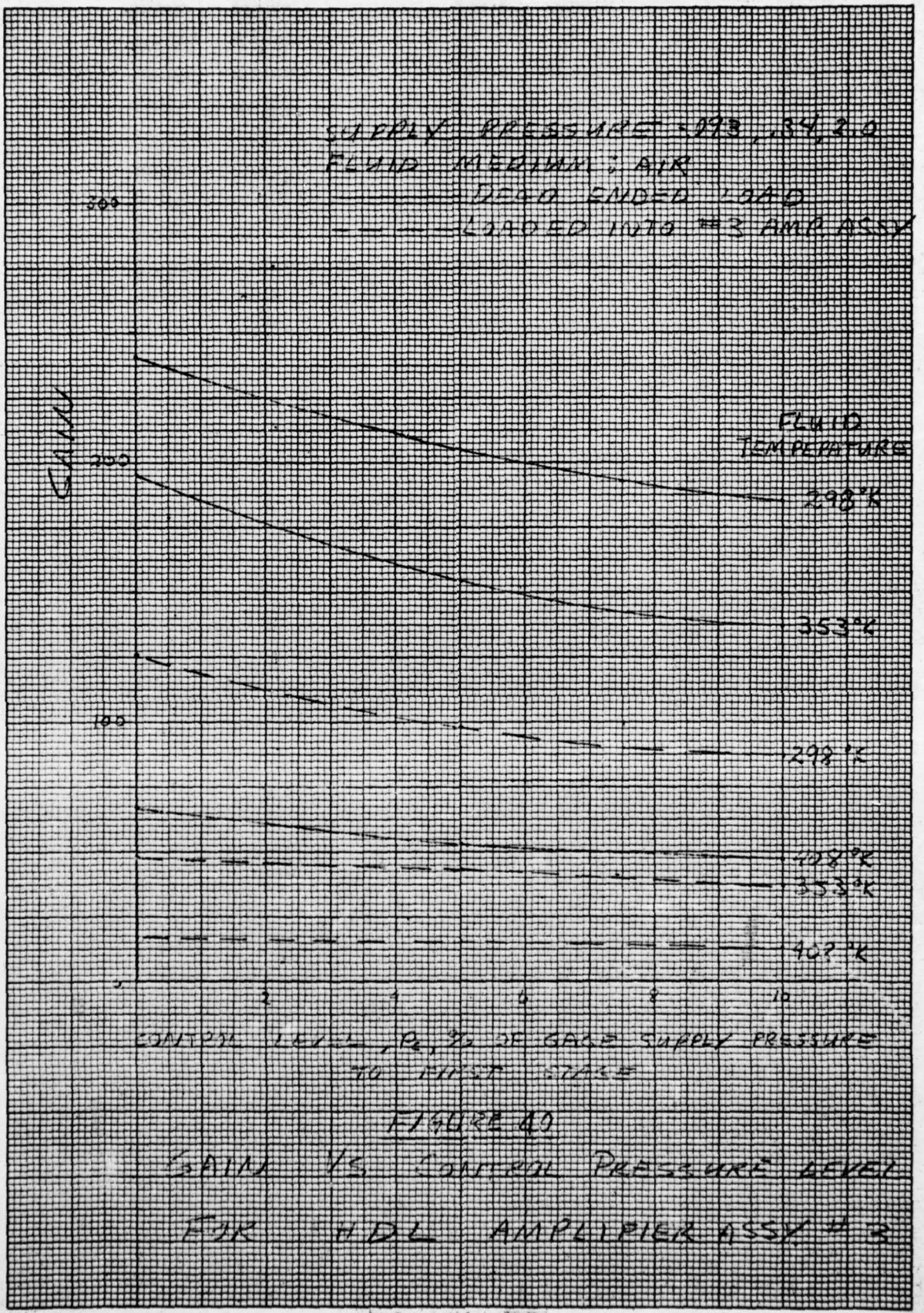



FIGURE 40

GAIN Vs. CONTROL PRESSURE LEVEL

FOR HDL AMPLIFIER ASSY # 2

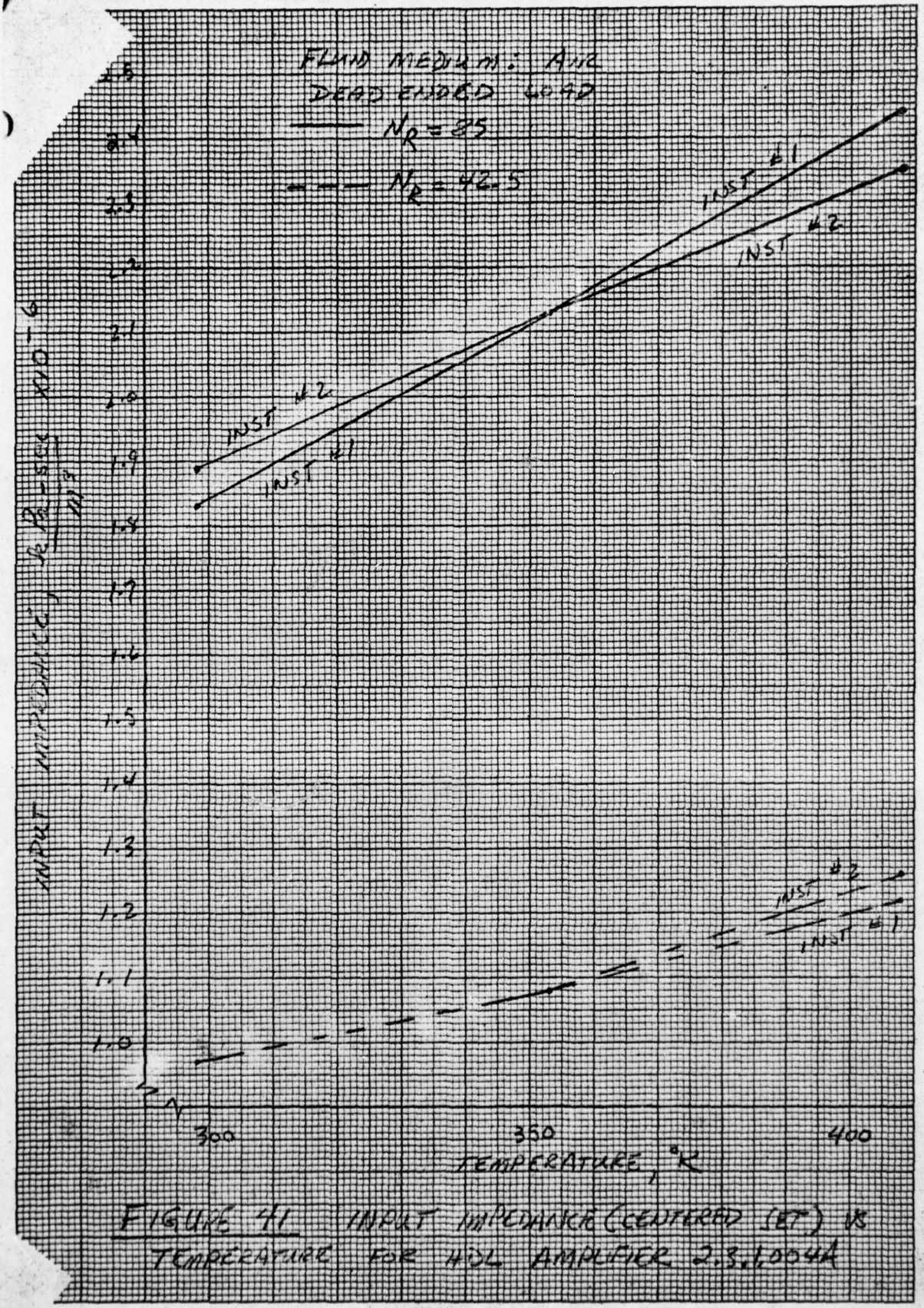



FIGURE 41 INPUT IMPEDANCE (CENTERED SET) VS TEMPERATURE FOR HDL AMPLIFIER 2.3.1.004A

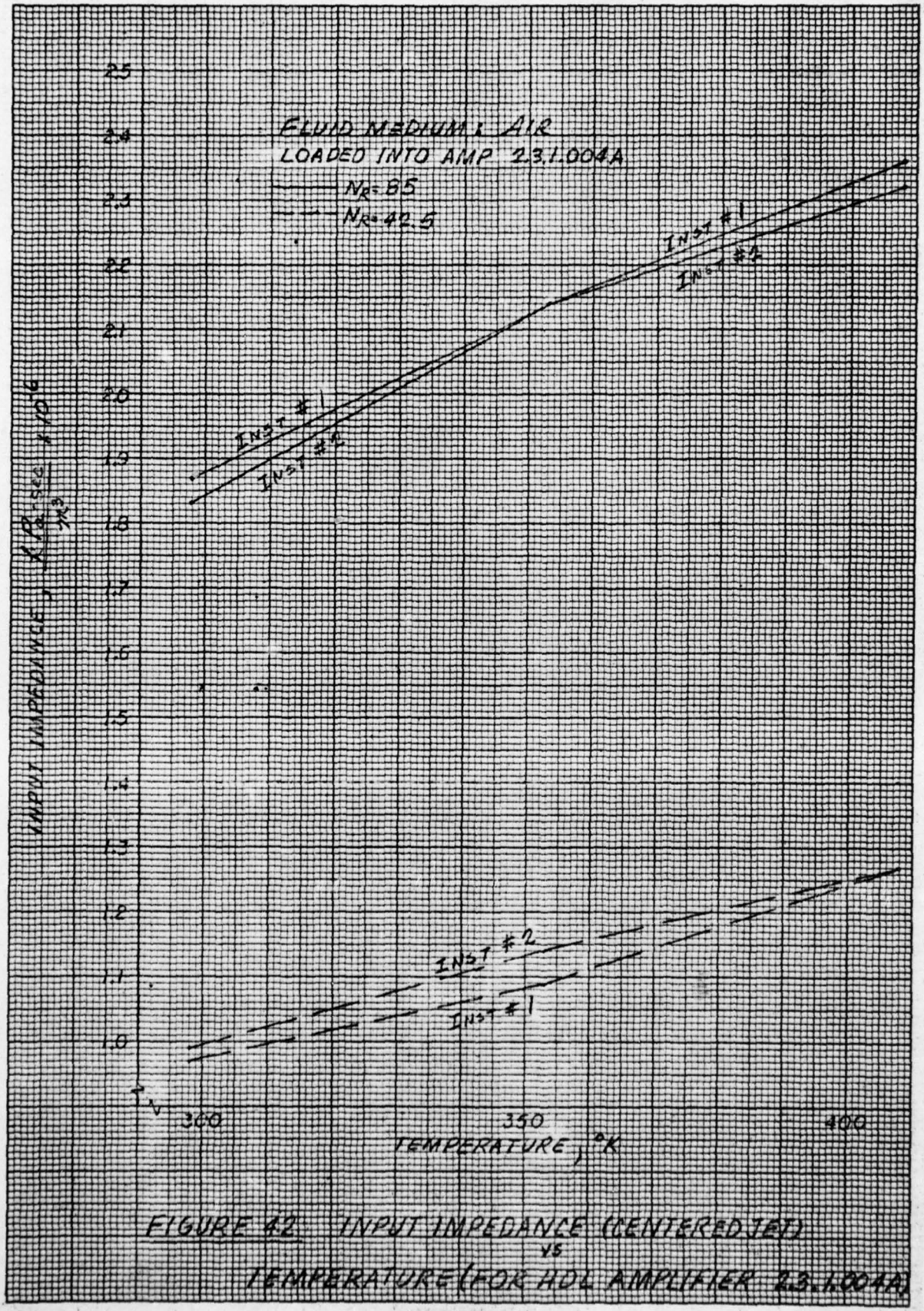



FIGURE 42 INPUT IMPEDANCE (CENTERED JET) VS TEMPERATURE (FOR ADL AMPLIFIER 2.3.1.004A)

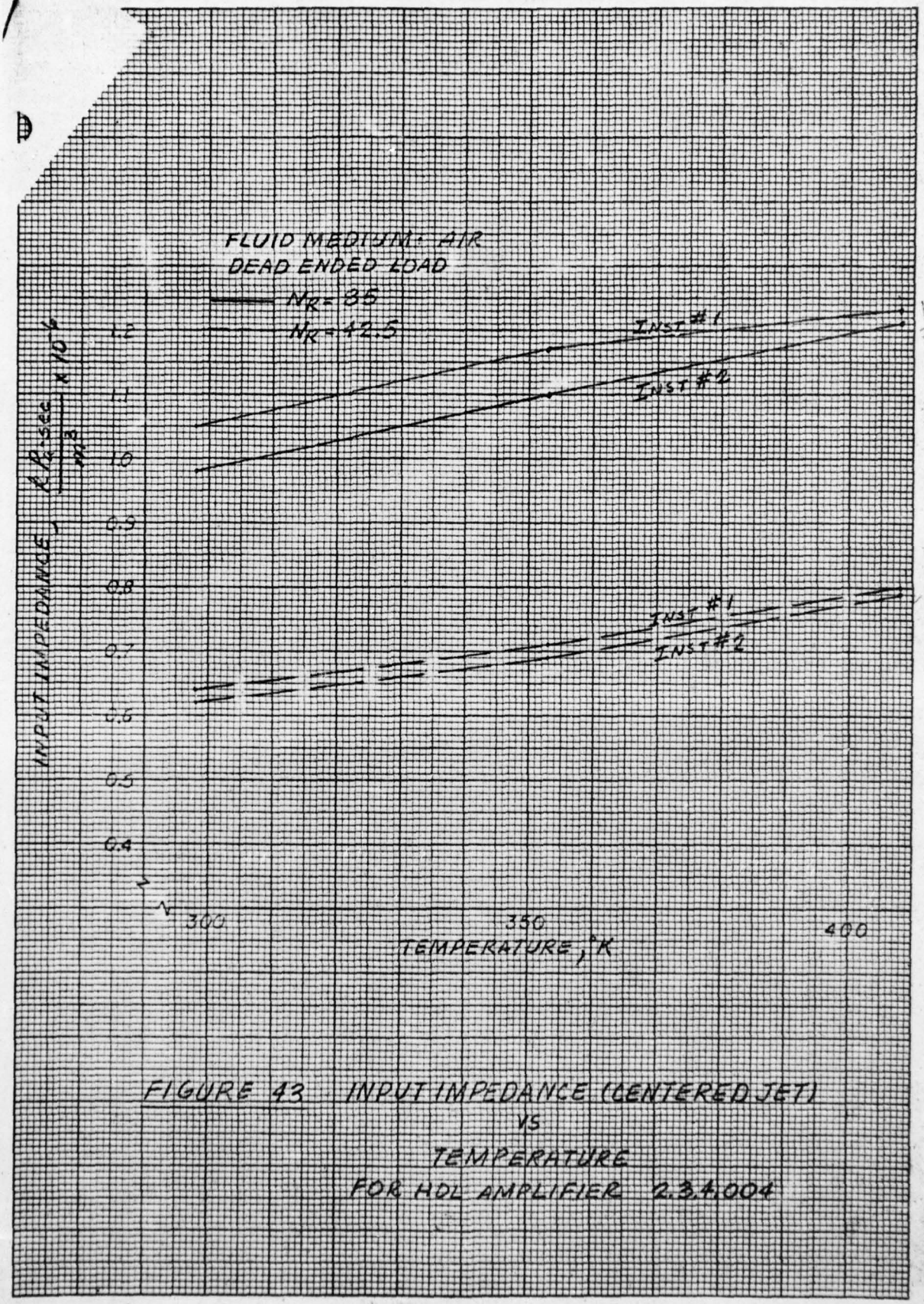



FIGURE 43 INPUT IMPEDANCE (CENTERED JET) VS TEMPERATURE FOR HDL AMPLIFIER 2.3.4.004

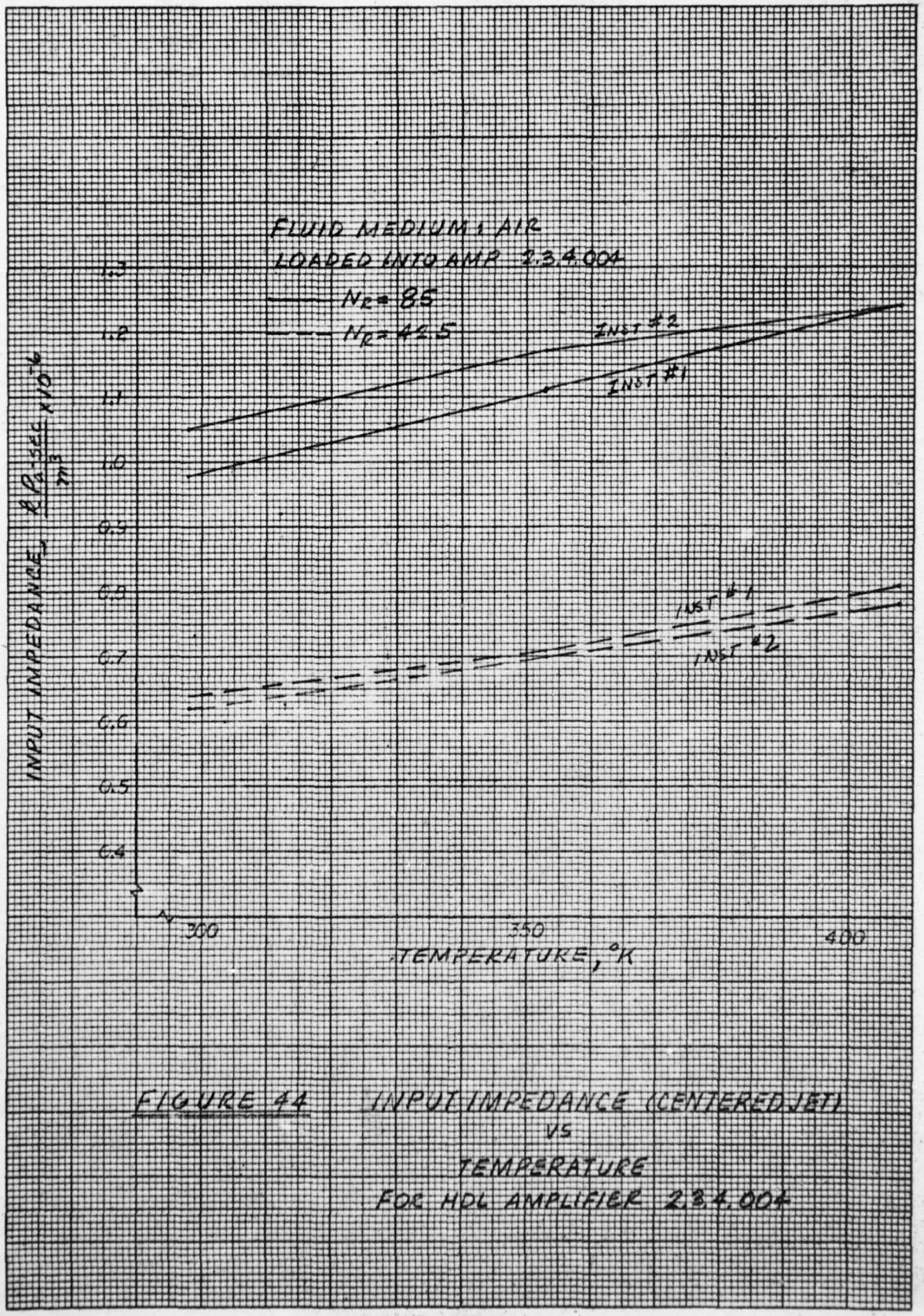
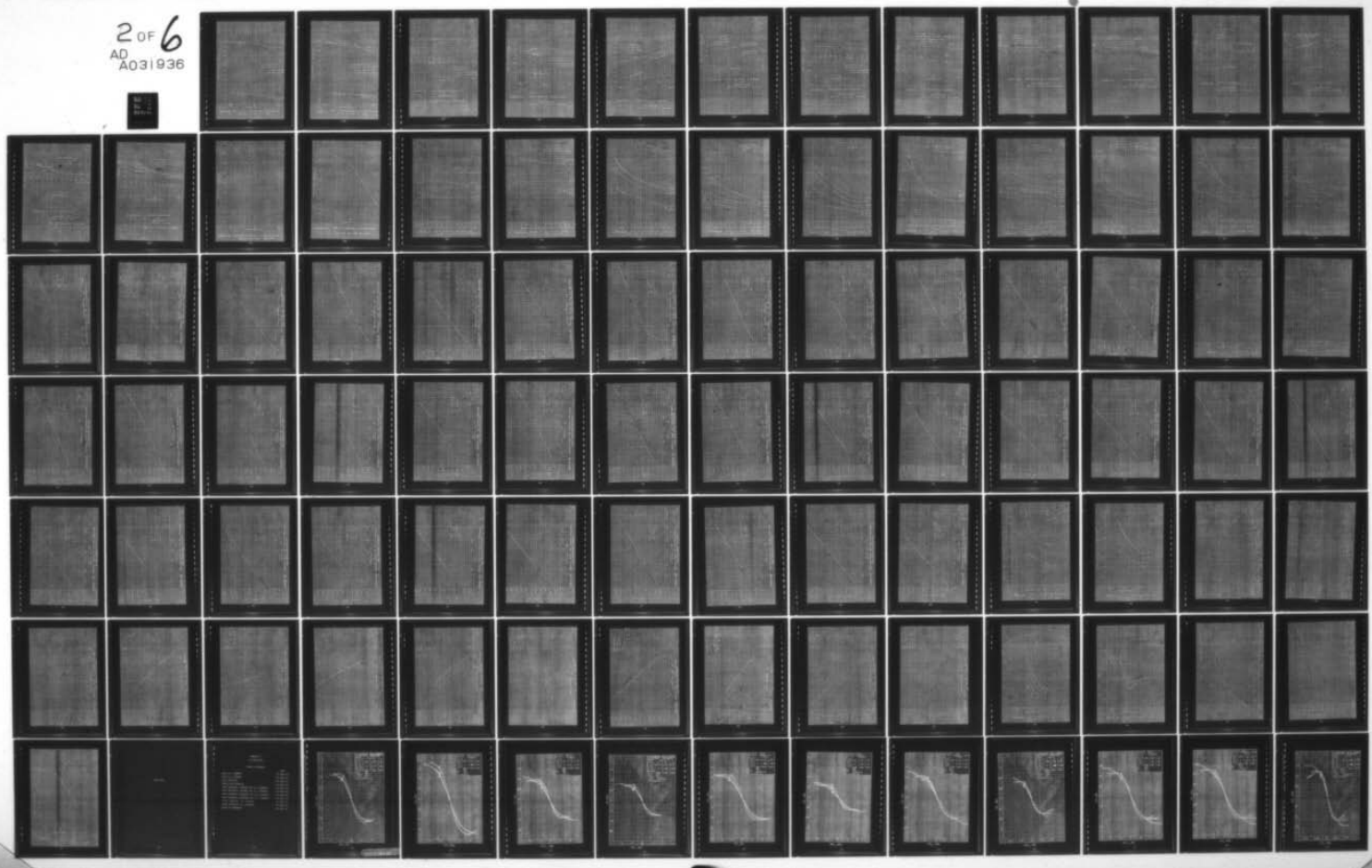



FIGURE 44 INPUT IMPEDANCE (CENTERED JET) VS TEMPERATURE FOR HDL AMPLIFIER 2.3.4.004

AD-A031 936 AIRESEARCH MFG CO OF ARIZONA PHOENIX F/G 20/4
ENVIRONMENTAL TEST PROGRAM FOR EVALUATION OF FLUIDIC ELEMENTS F--ETC(U)
DEC 75 M F CYCON, T G SUTTON, H R GAMBLE DAAG39-74-C-0187
UNCLASSIFIED 75-411145 HDL-CR-75-187-1 NL

2 OF 6
AD A031936



2 OF 6

AD A031936



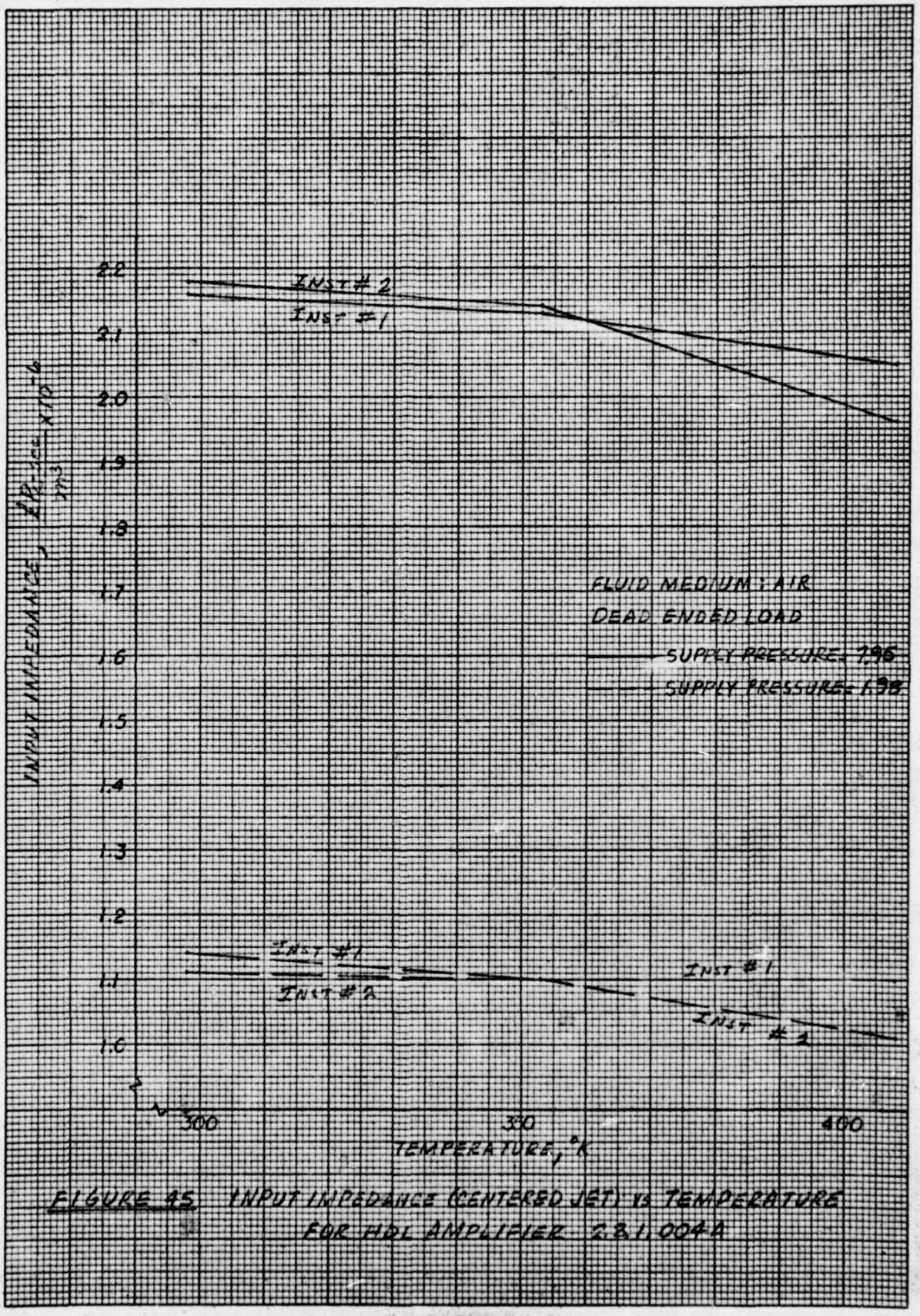



FIGURE 45. INPUT IMPEDANCE (CENTERED JET) VS TEMPERATURE FOR HDL AMPLIFIER 2.8.1.004-A

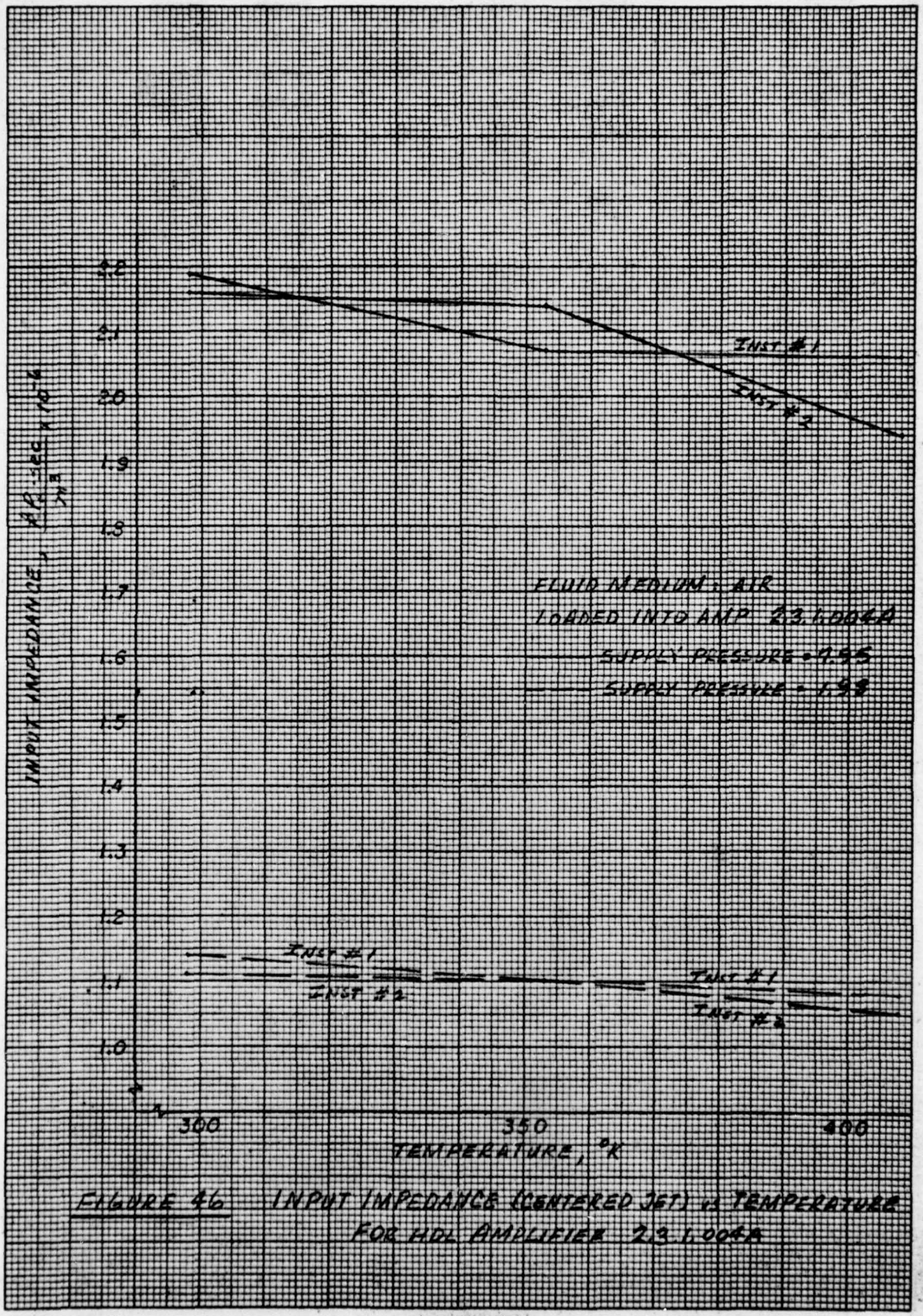



FIGURE 46 INPUT IMPEDANCE (CENTERED JET) VS TEMPERATURE FOR HDL AMPLIFIER 23.1.004A

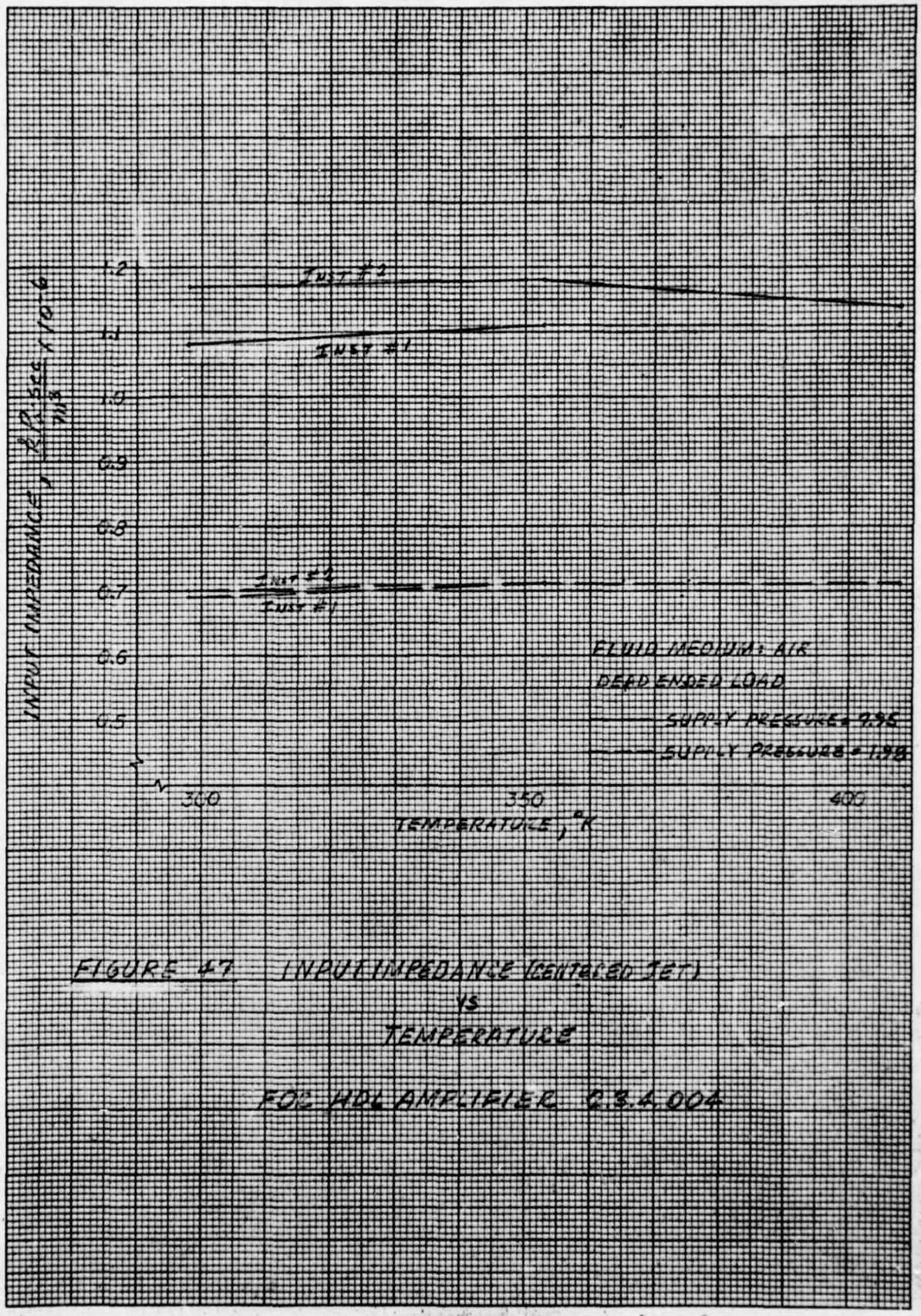



FIGURE 47 INPUT IMPEDANCE (CENTERED JET) VS TEMPERATURE FOR HDL AMPLIFIER C.3.4.004

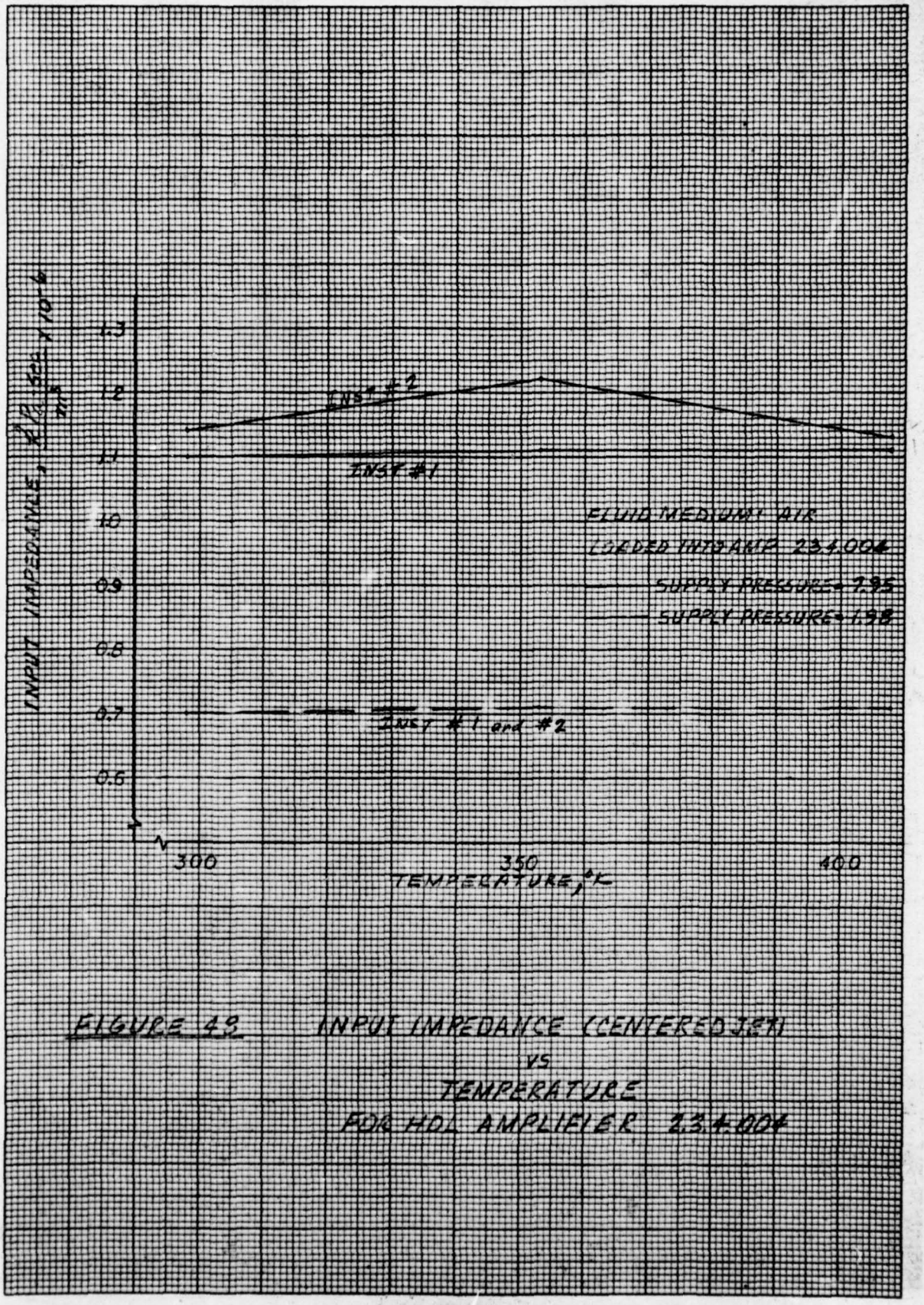



FIGURE 43. INPUT IMPEDANCE (CENTERED JET) VS TEMPERATURE FOR HDL AMPLIFIER 234004

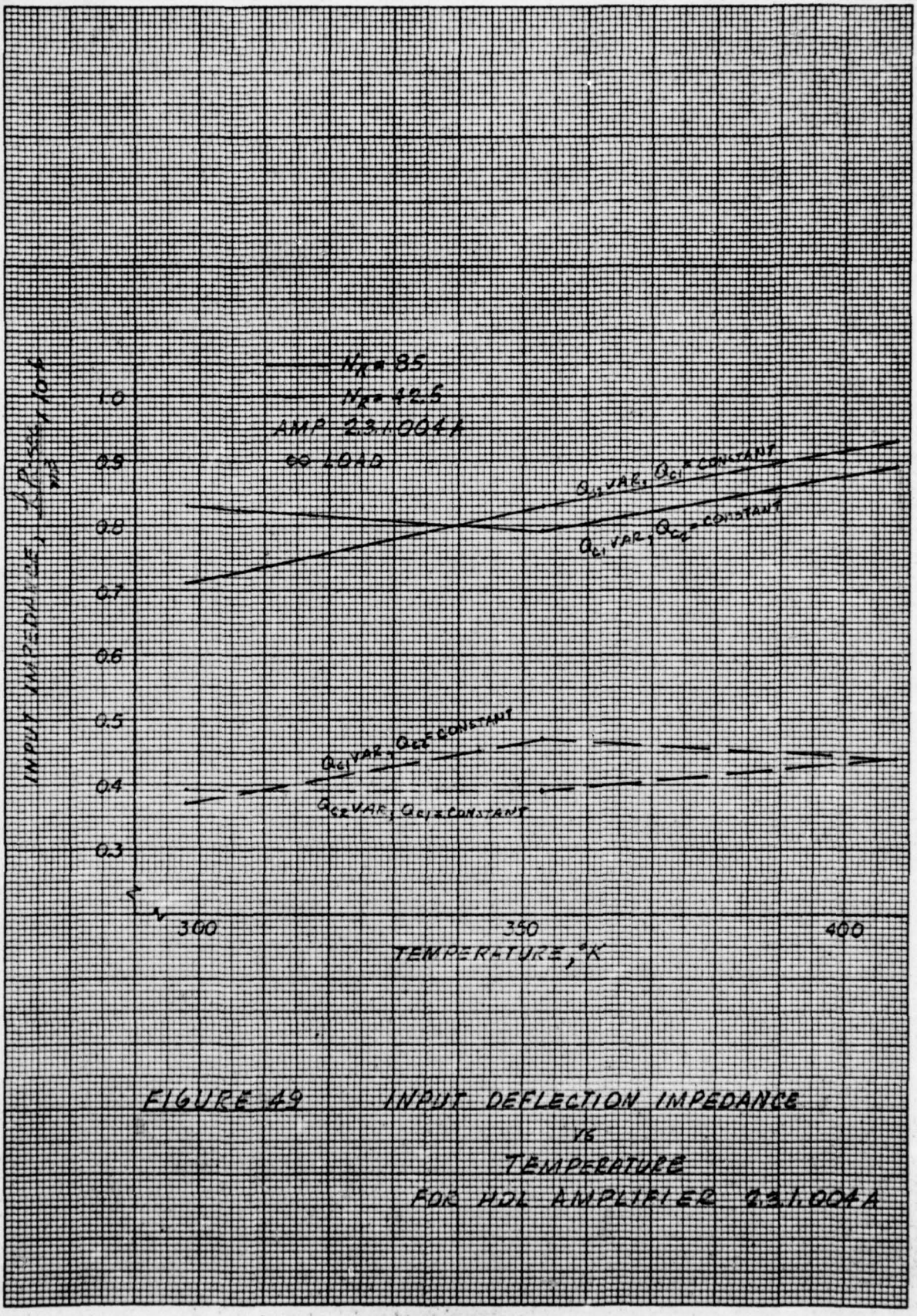



FIGURE 49 INPUT DEFLECTION IMPEDANCE VS TEMPERATURE FOR HDL AMPLIFIER 231.004A

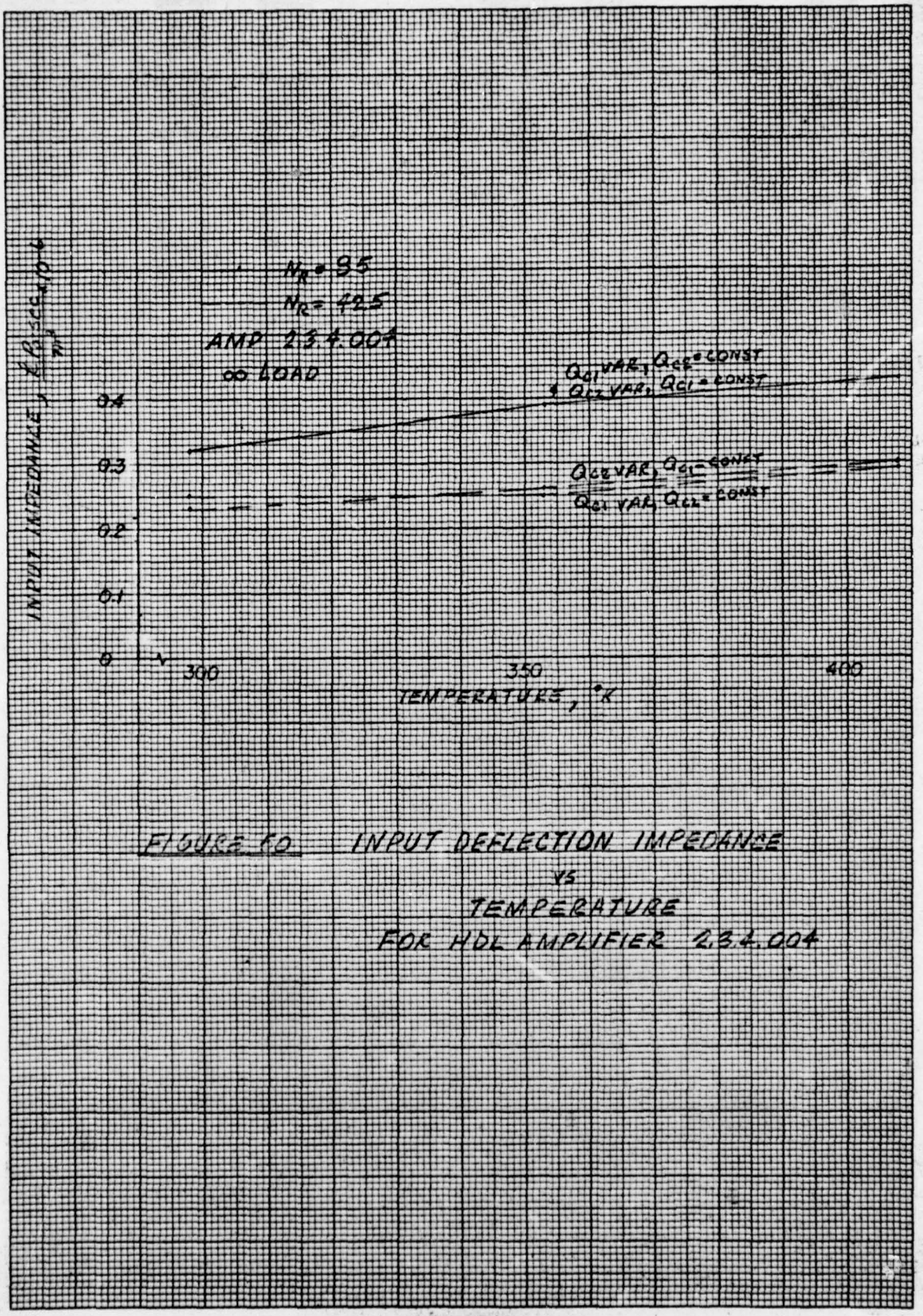



FIGURE 50 INPUT DEFLECTION IMPEDANCE
VS
TEMPERATURE
FOR HDL AMPLIFIER 2.3.4.004

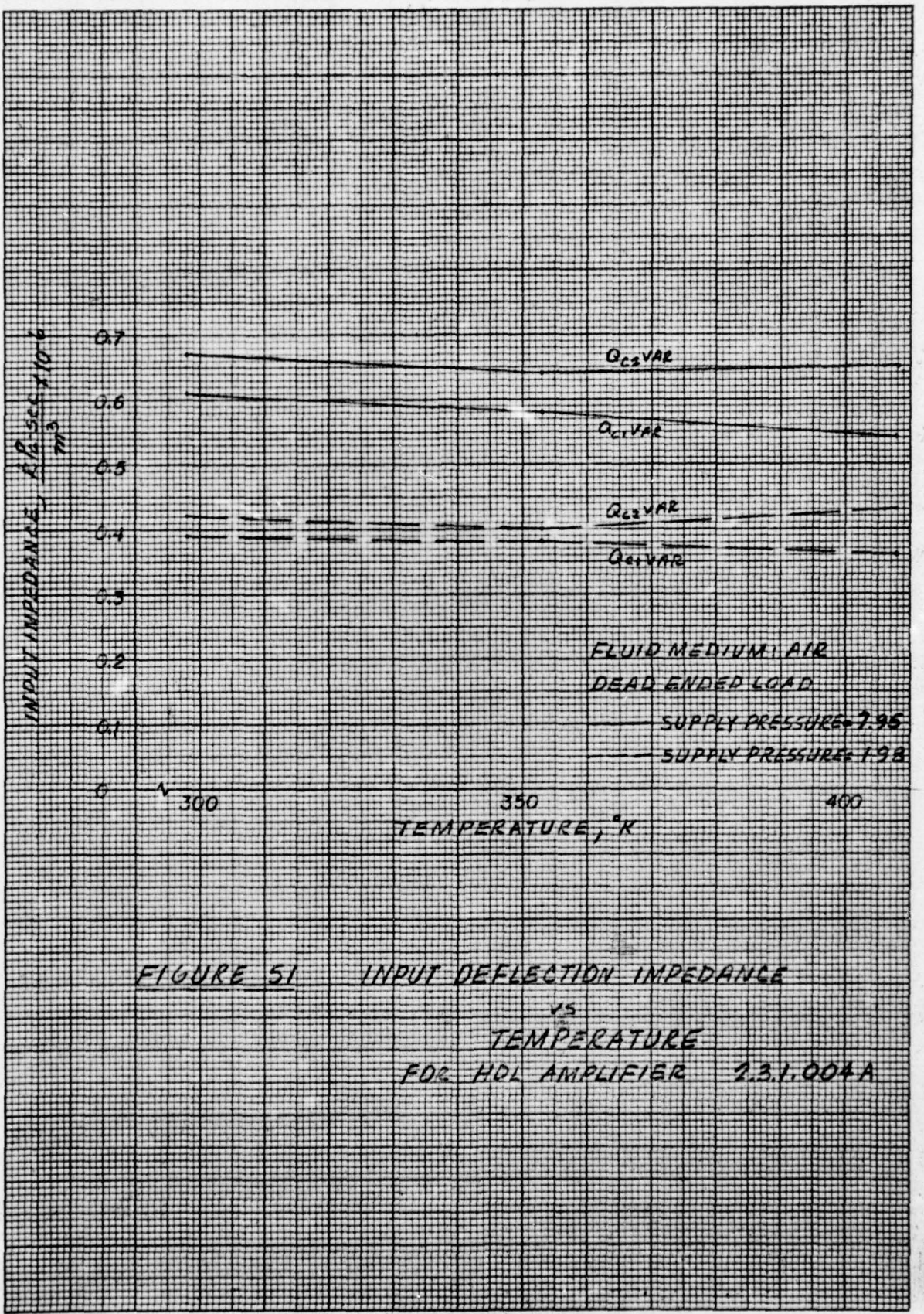



FIGURE 51 INPUT DEFLECTION IMPEDANCE VS TEMPERATURE FOR HDL AMPLIFIER 2.3.1.004A

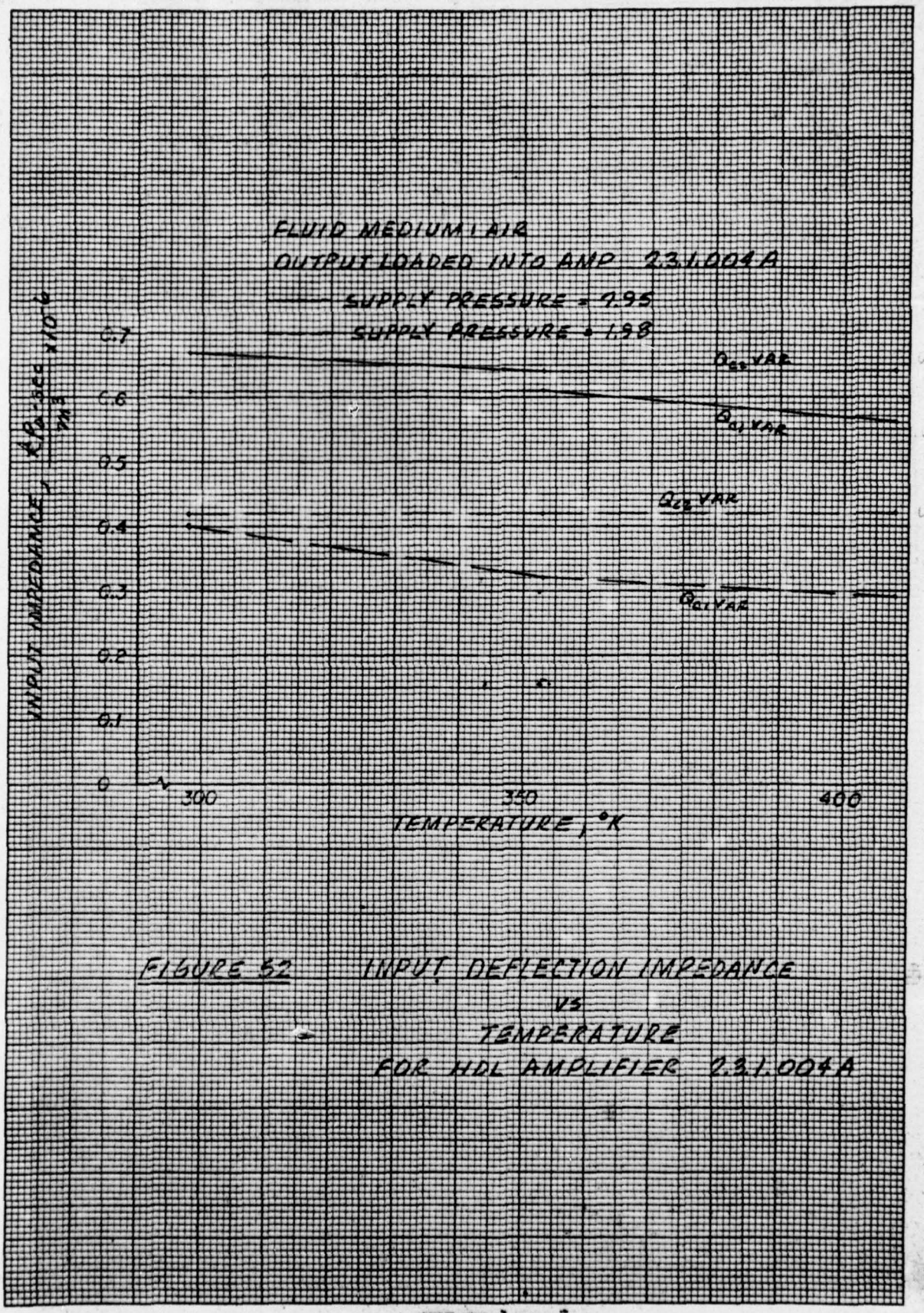



FIGURE 52 INPUT DEFLECTION IMPEDANCE VS TEMPERATURE FOR HDL AMPLIFIER 2.3.1.004A

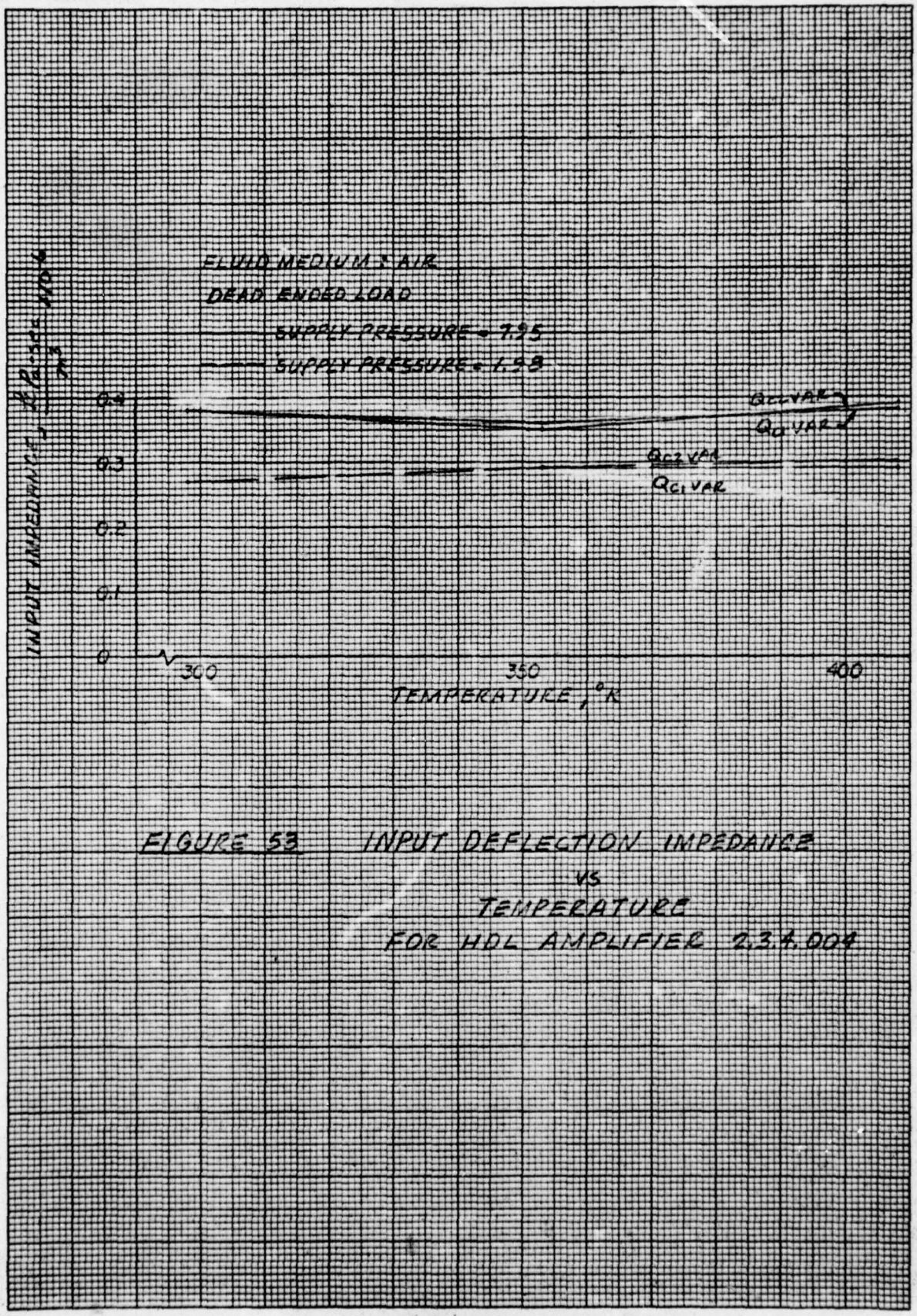



FIGURE 53 INPUT DEFLECTION IMPEDANCE VS TEMPERATURE FOR HDL AMPLIFIER 2,3,4,004

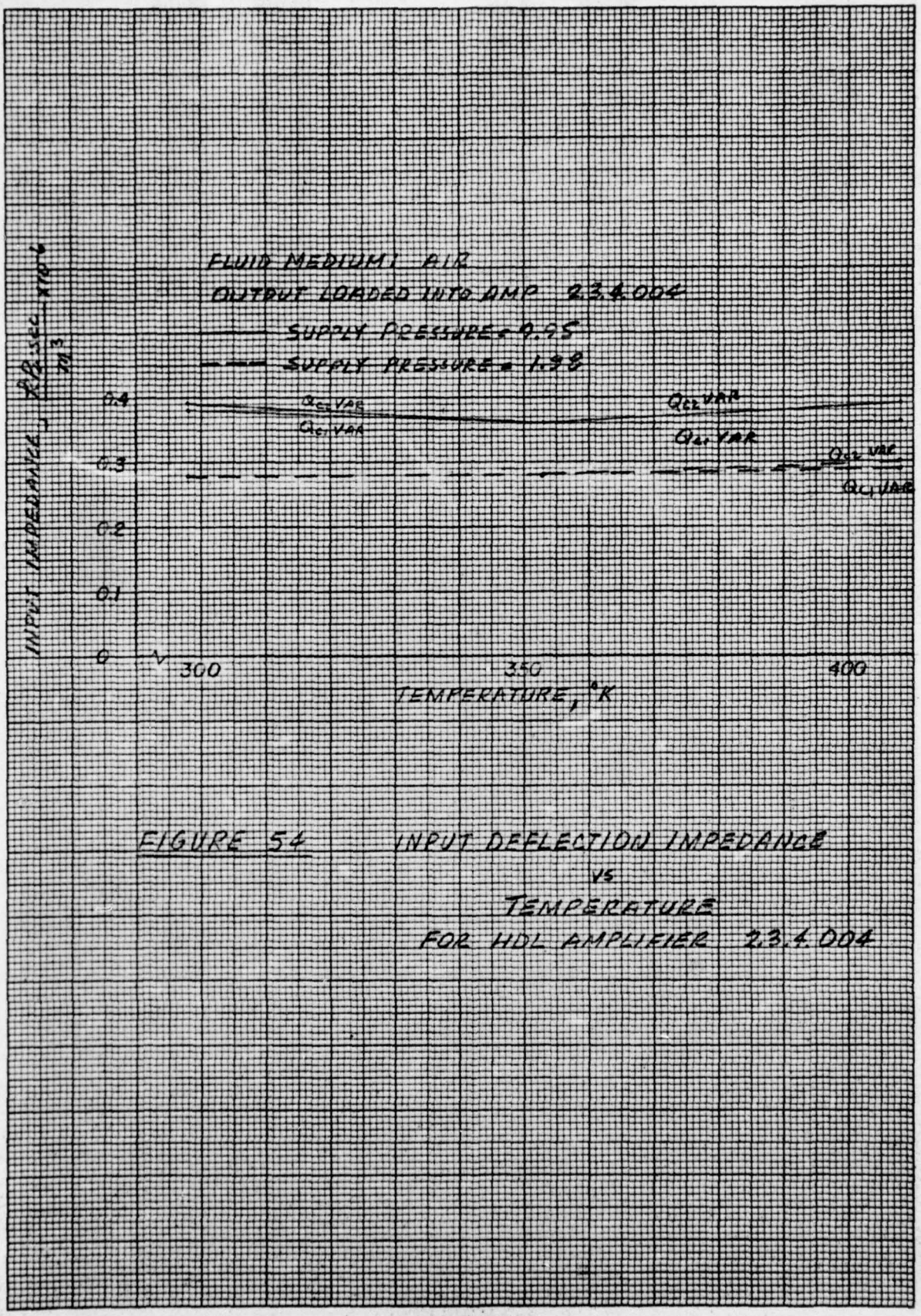



FIGURE 54 INPUT DEFLECTION IMPEDANCE VS TEMPERATURE FOR HDL AMPLIFIER 2.3.4.004

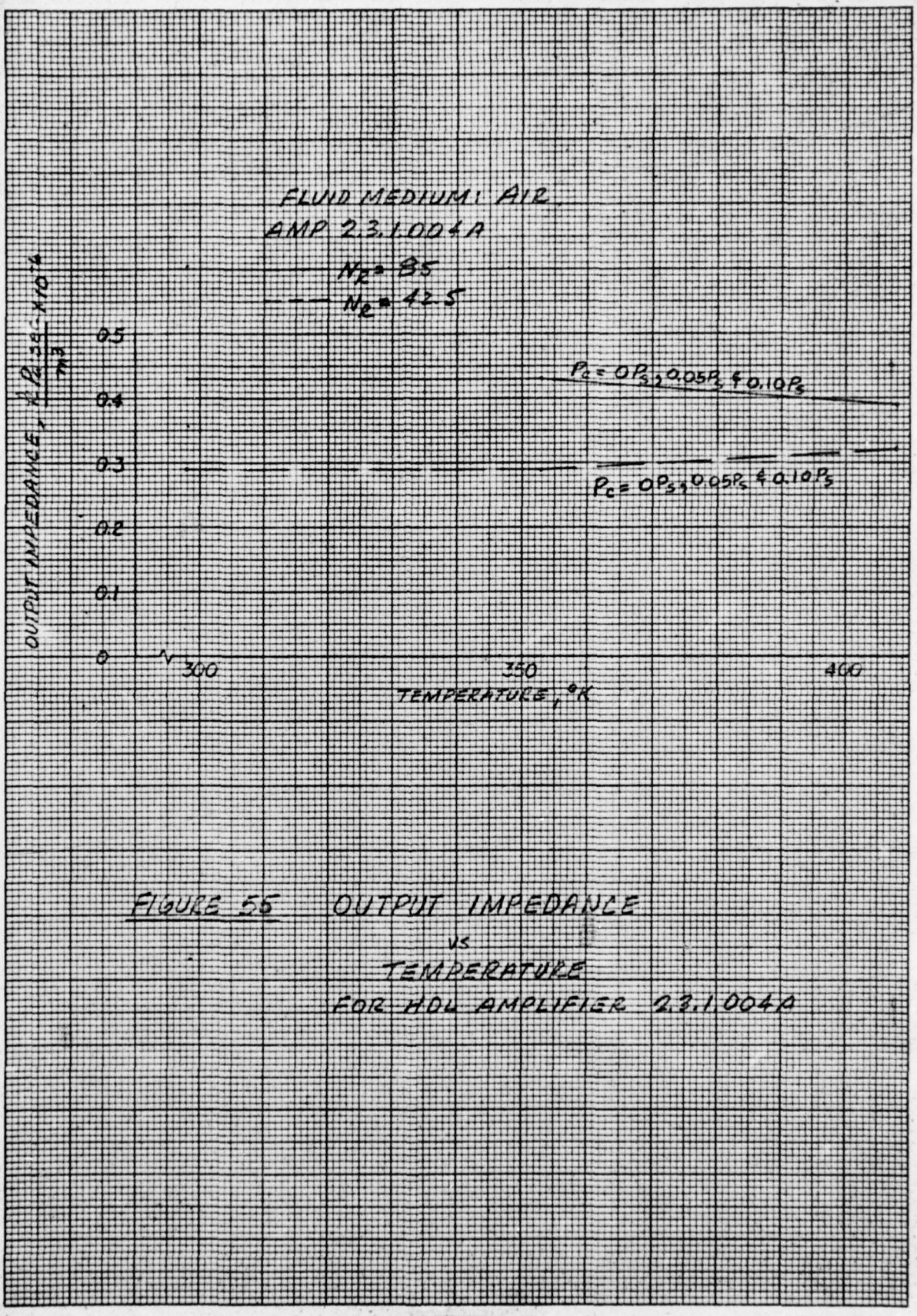



FIGURE 55 OUTPUT IMPEDANCE VS TEMPERATURE FOR HDL AMPLIFIER 2.3.1.004A

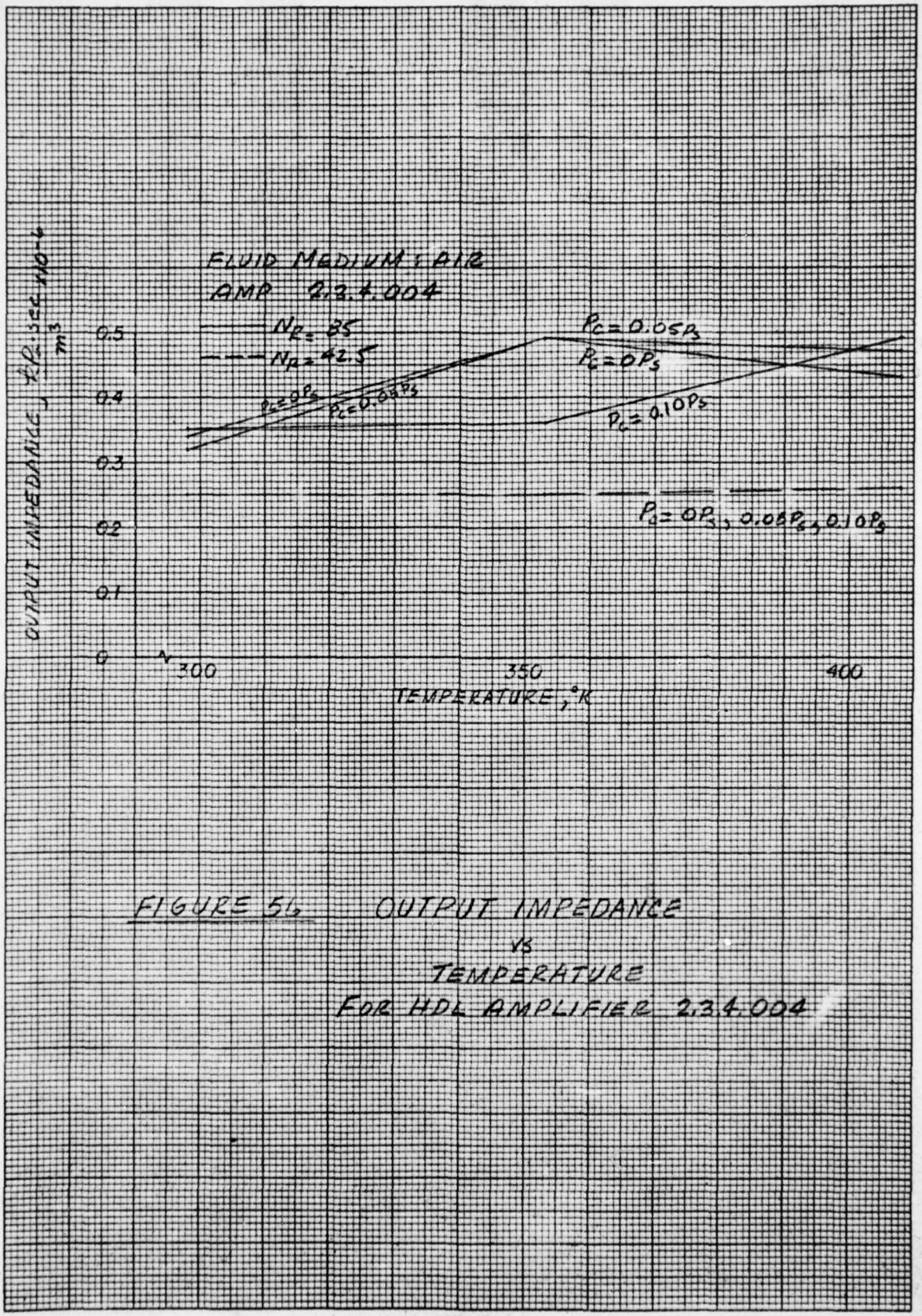



FIGURE 56 OUTPUT IMPEDANCE VS TEMPERATURE FOR HDL AMPLIFIER 2.3.4.004

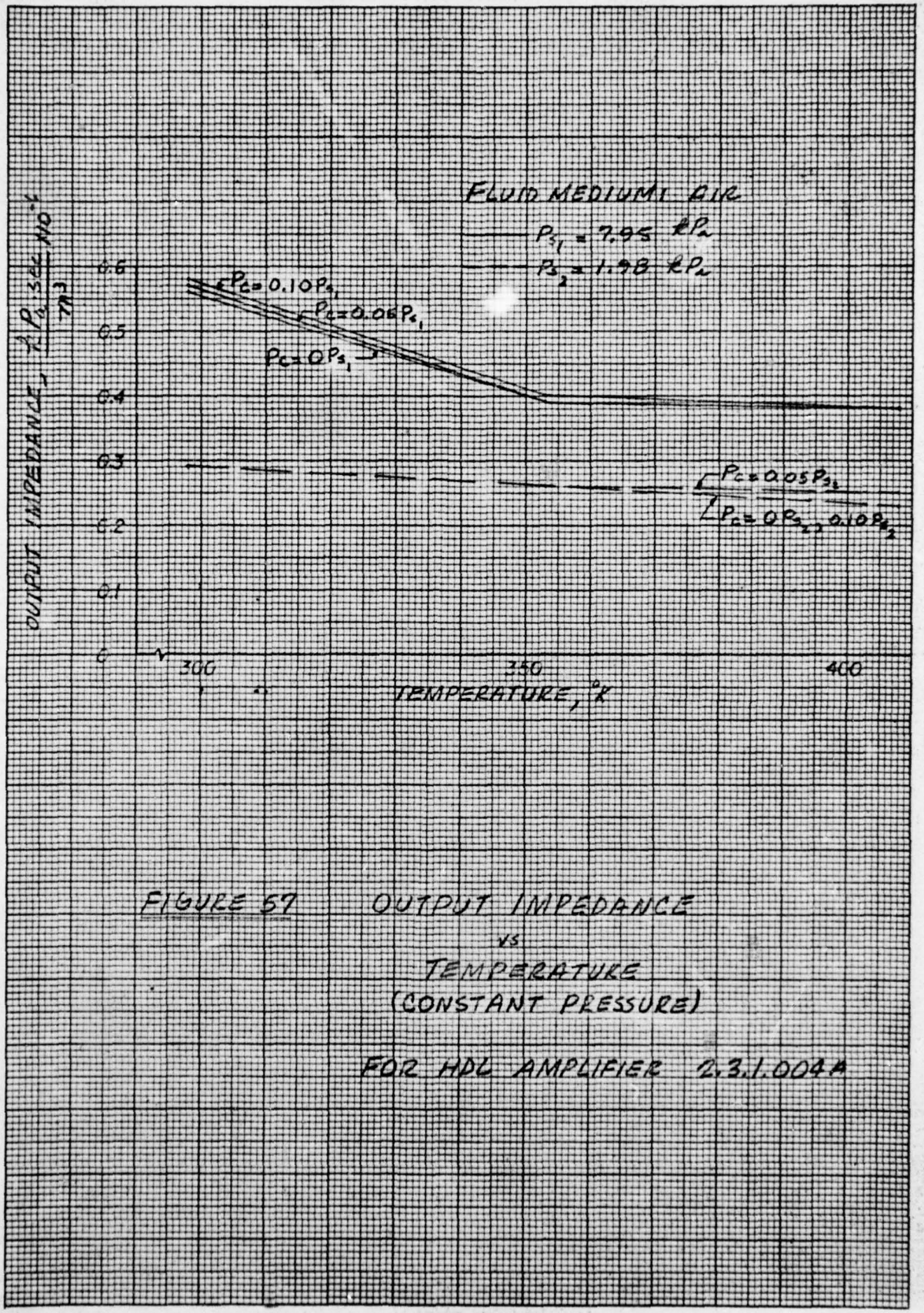



FIGURE 57 OUTPUT IMPEDANCE
VS
TEMPERATURE
(CONSTANT PRESSURE)
FOR HDL AMPLIFIER 2.3.1.004A

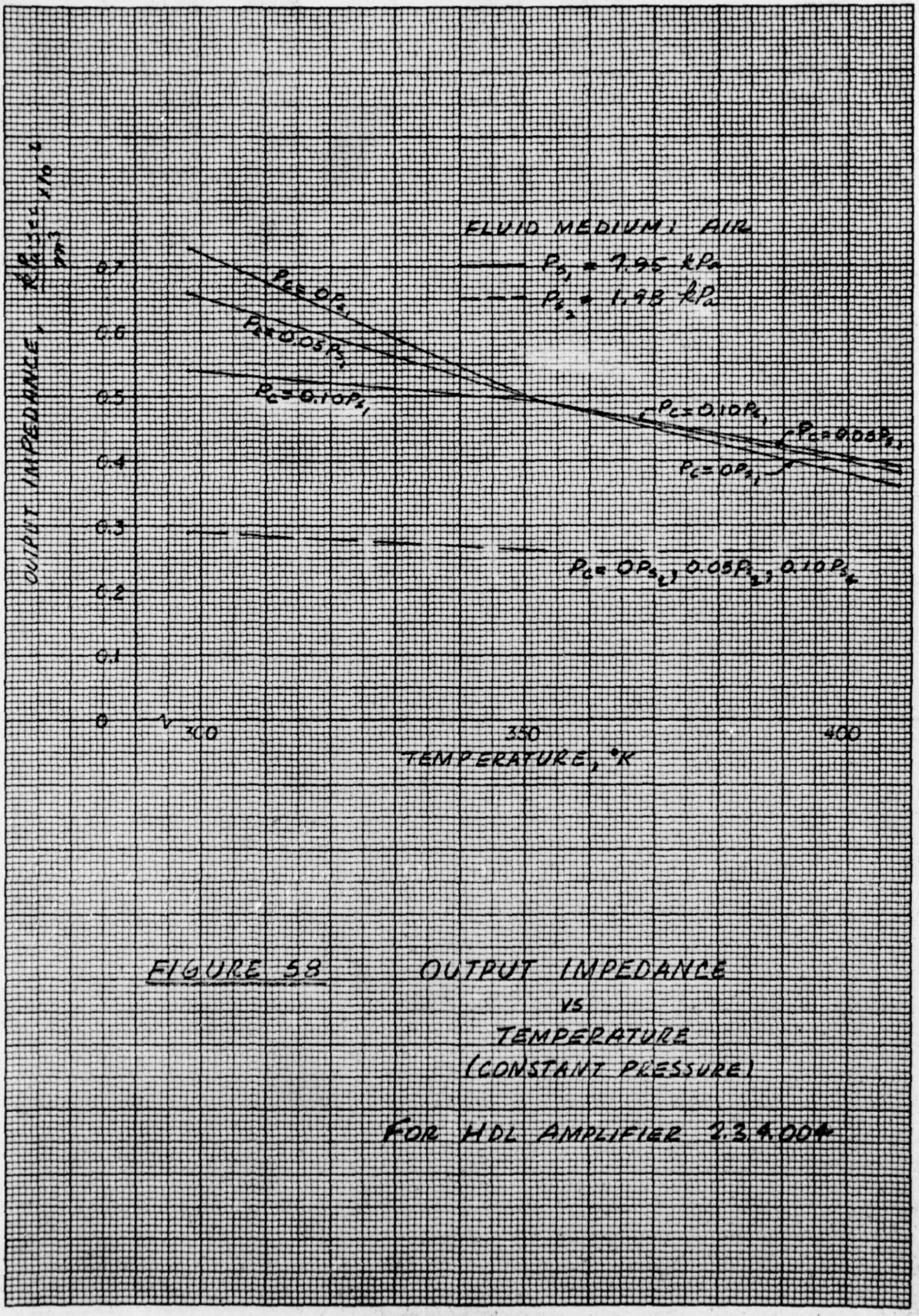



FIGURE 58 OUTPUT IMPEDANCE VS TEMPERATURE (CONSTANT PRESSURE)

FOR HDL AMPLIFIER 2.3.4.004

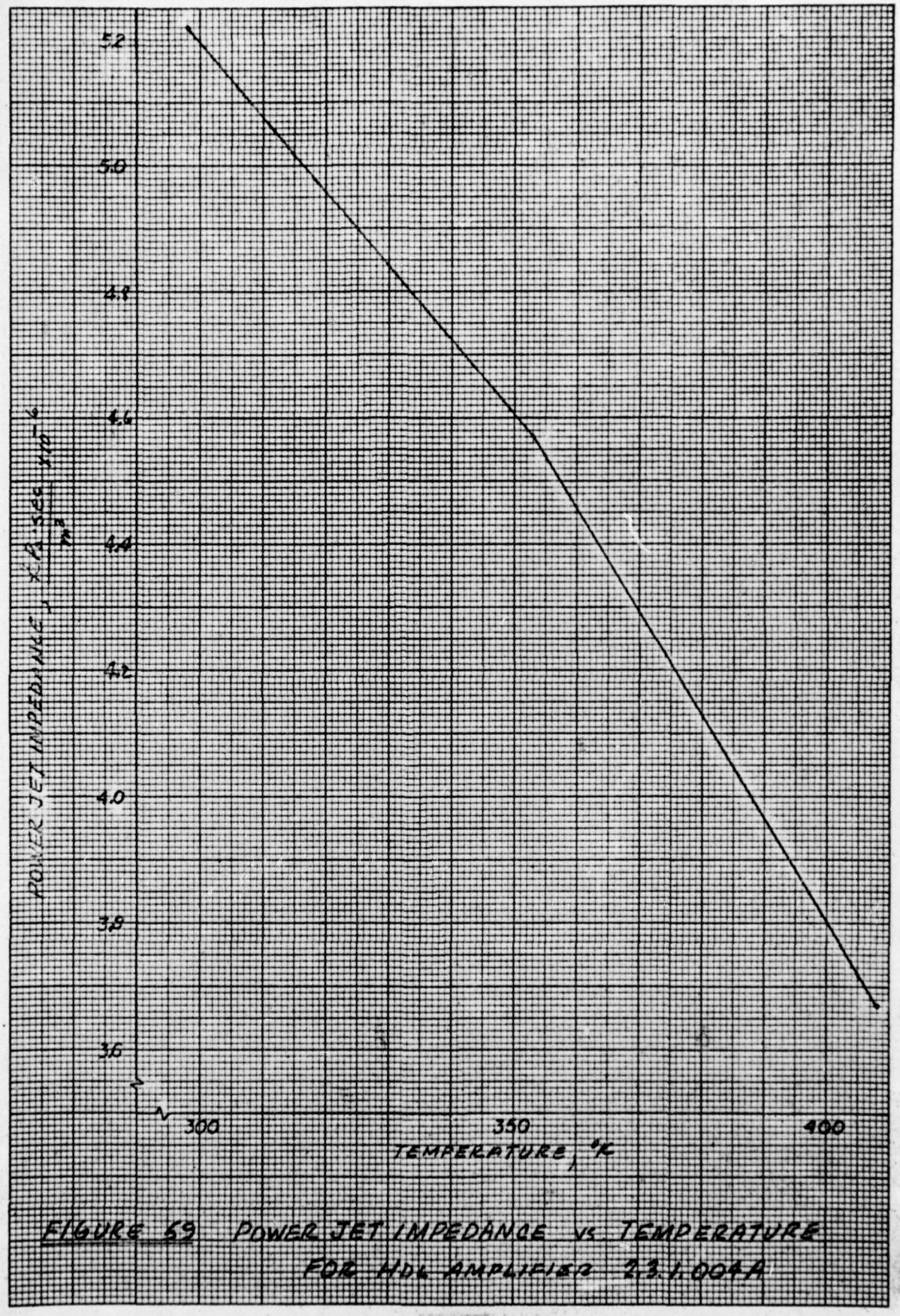



FIGURE 59 POWER JET IMPEDANCE VS. TEMPERATURE FOR HDL AMPLIFIER 2.3.1.004A

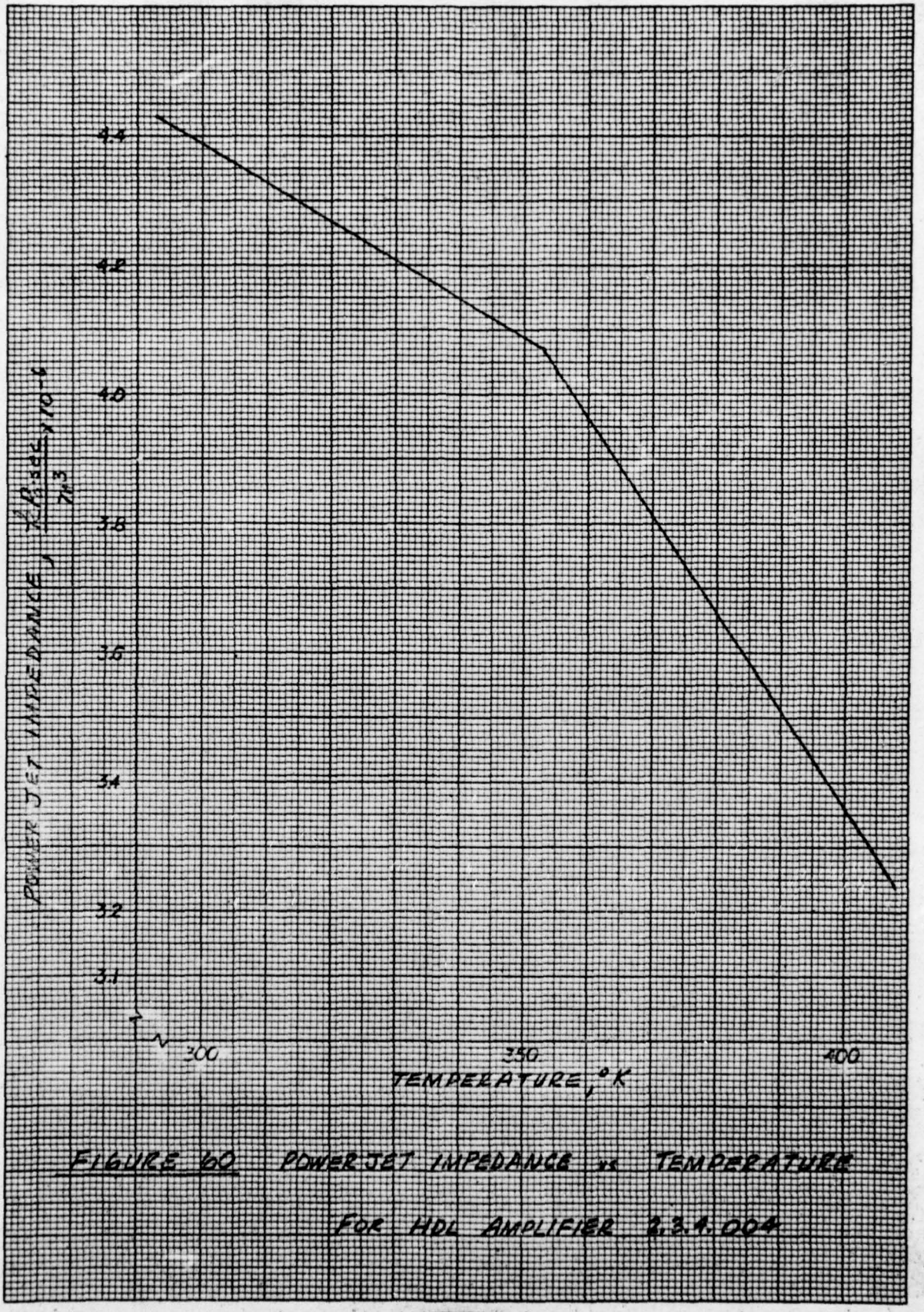



FIGURE 60 POWER JET IMPEDANCE vs TEMPERATURE FOR HDL AMPLIFIER 2.3.4.004

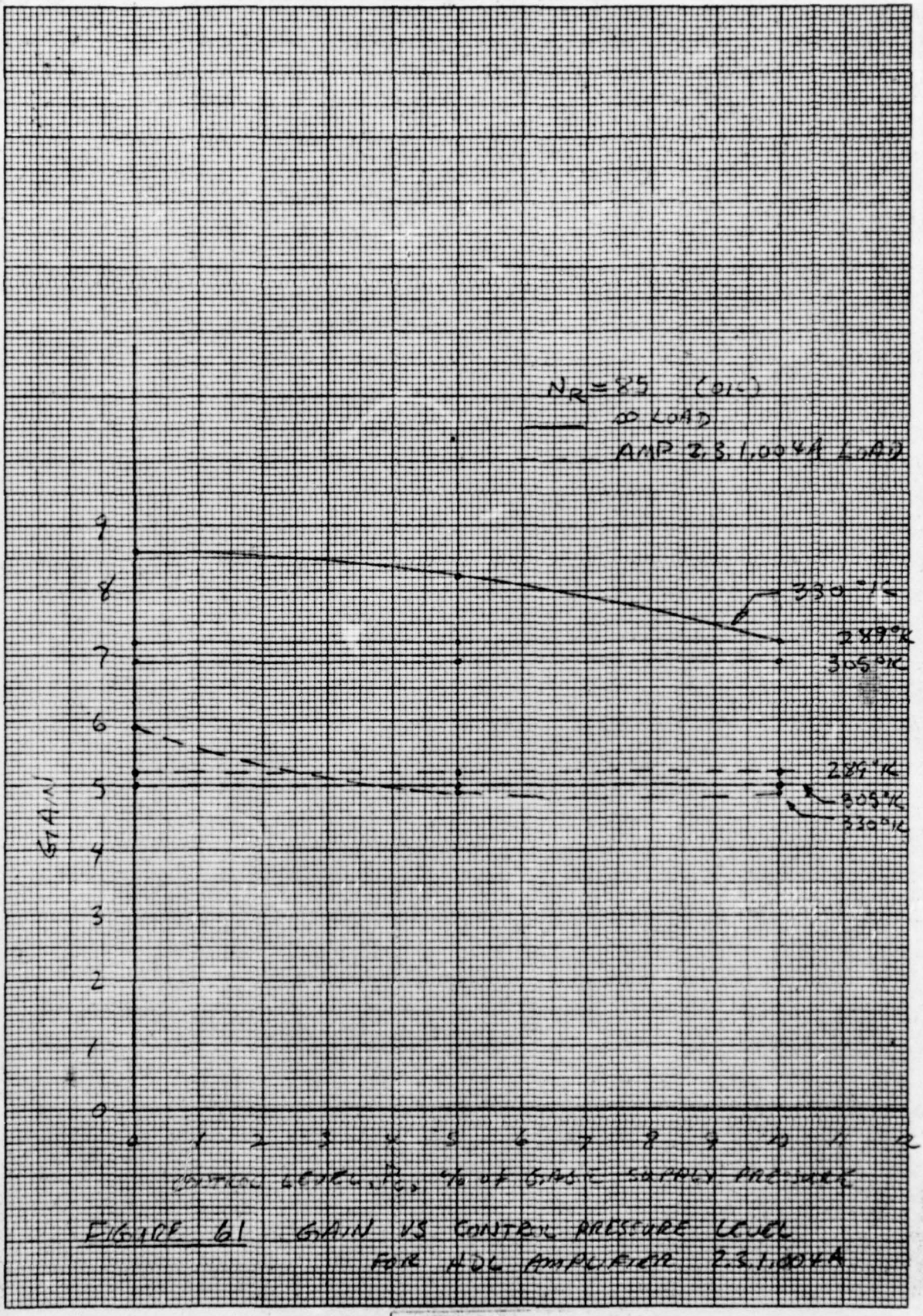



FIGURE 61 GAIN VS CONTROL PRESSURE LEVEL FOR #04 AMPLIFIER 2.3.1.004A

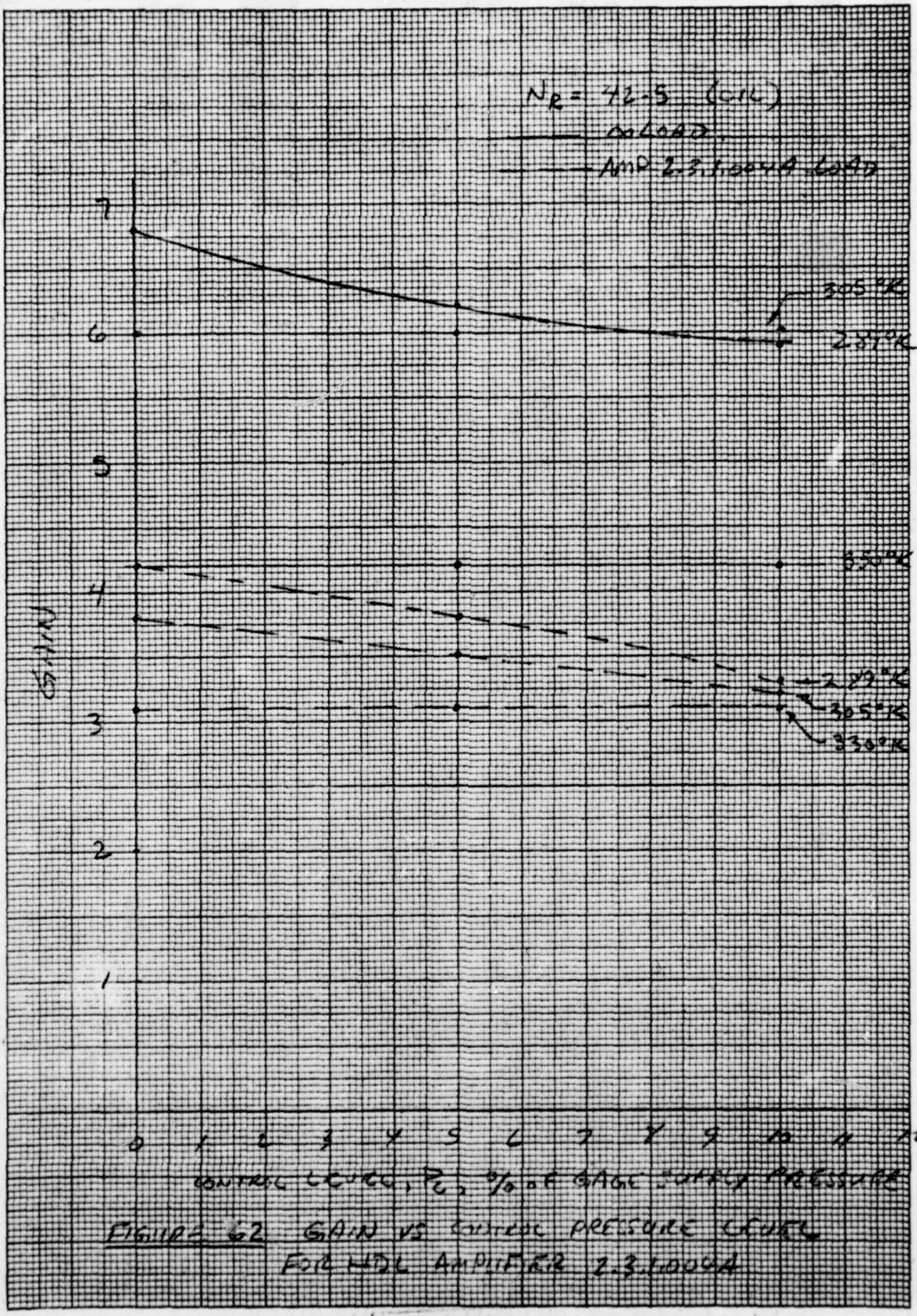



FIGURE 62 GAIN VS CONTROL PRESSURE CHART FOR HDL AMPLIFIER 2.3.1004A

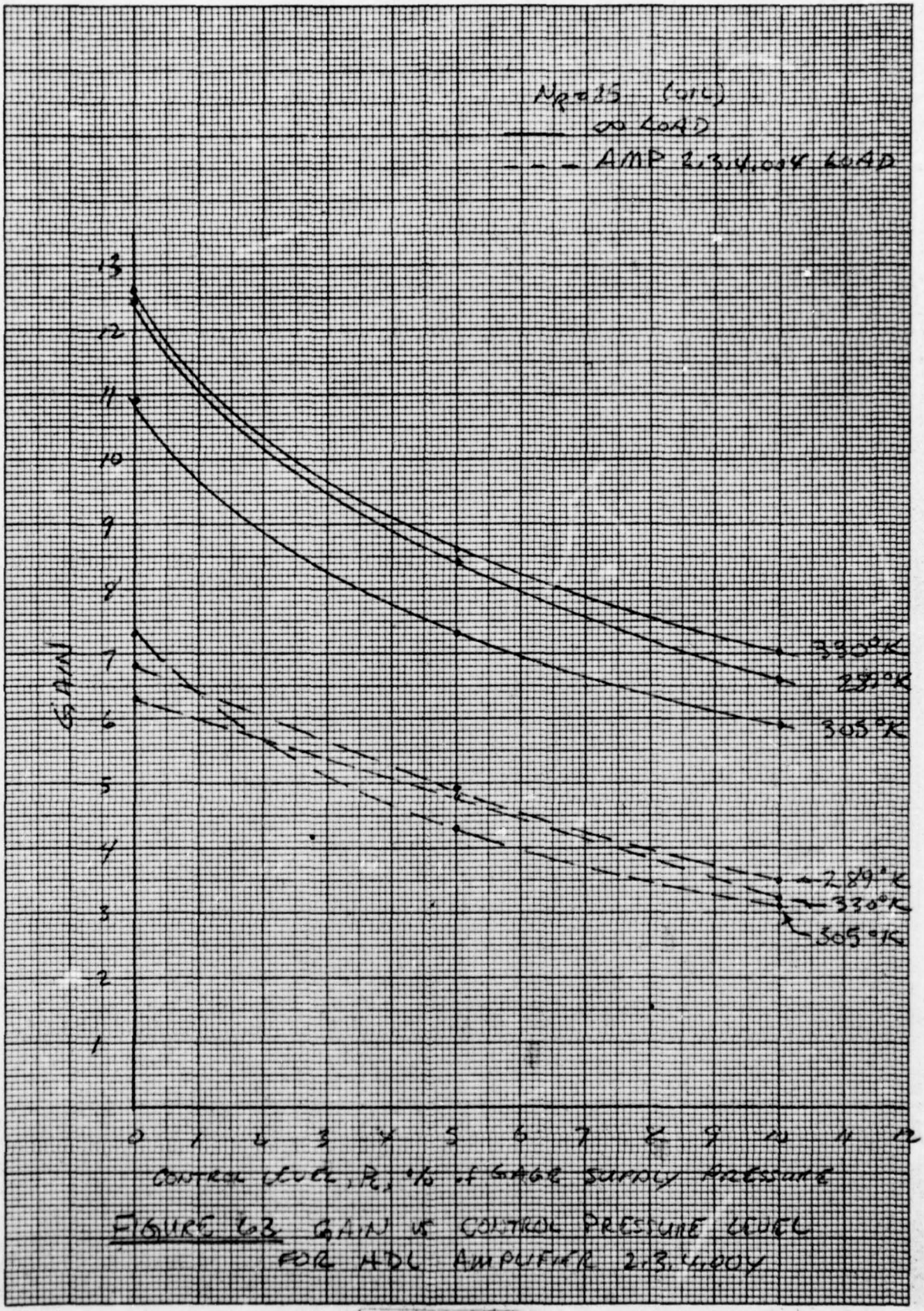



FIGURE 6B GAIN VS CONTROL PRESSURE LEVEL FOR HDL AMPLIFIER 2,3,4,004

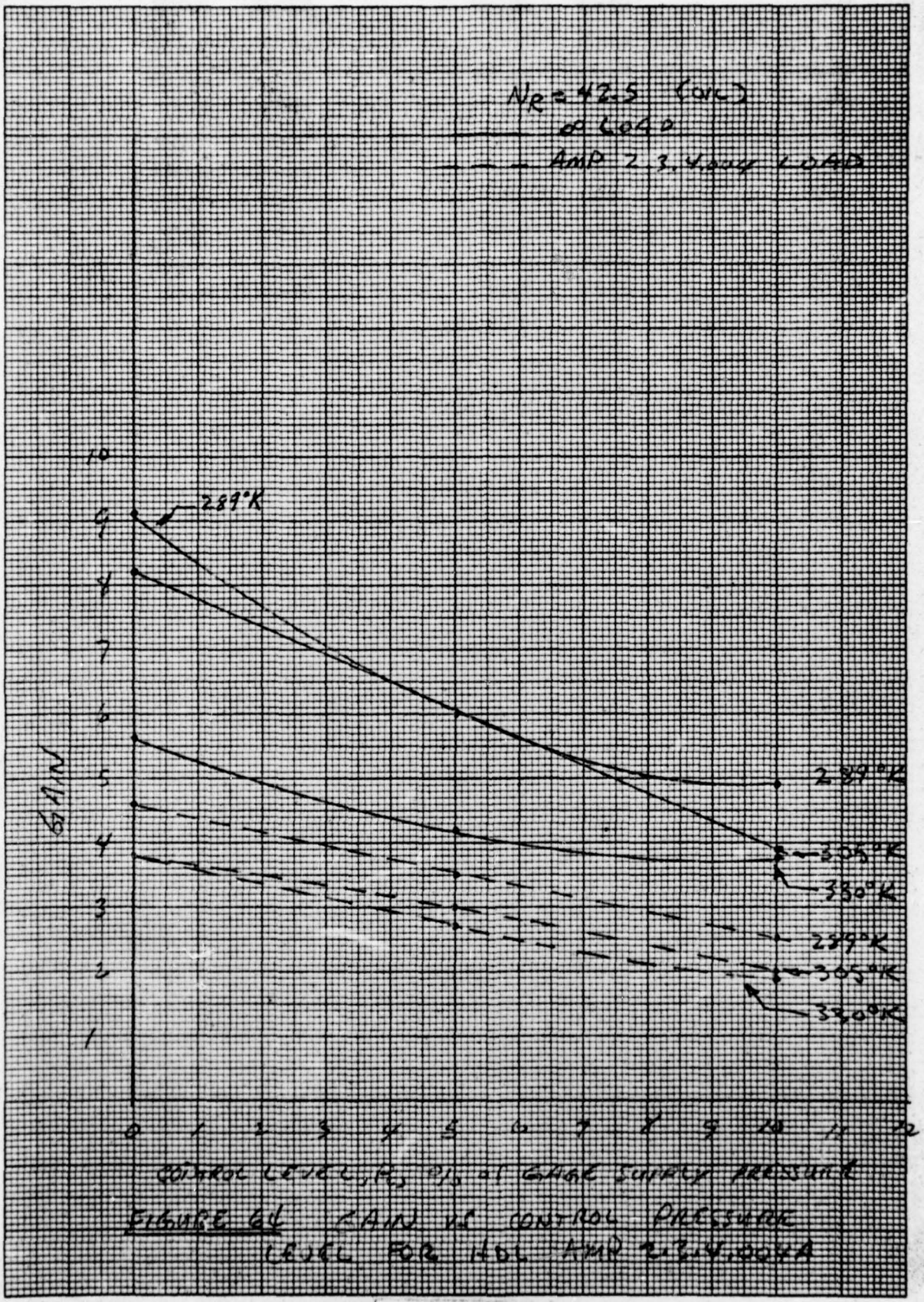



FIGURE 64 GAIN VS CONTROL PRESSURE LEVEL FOR HOT RUN REACTOR

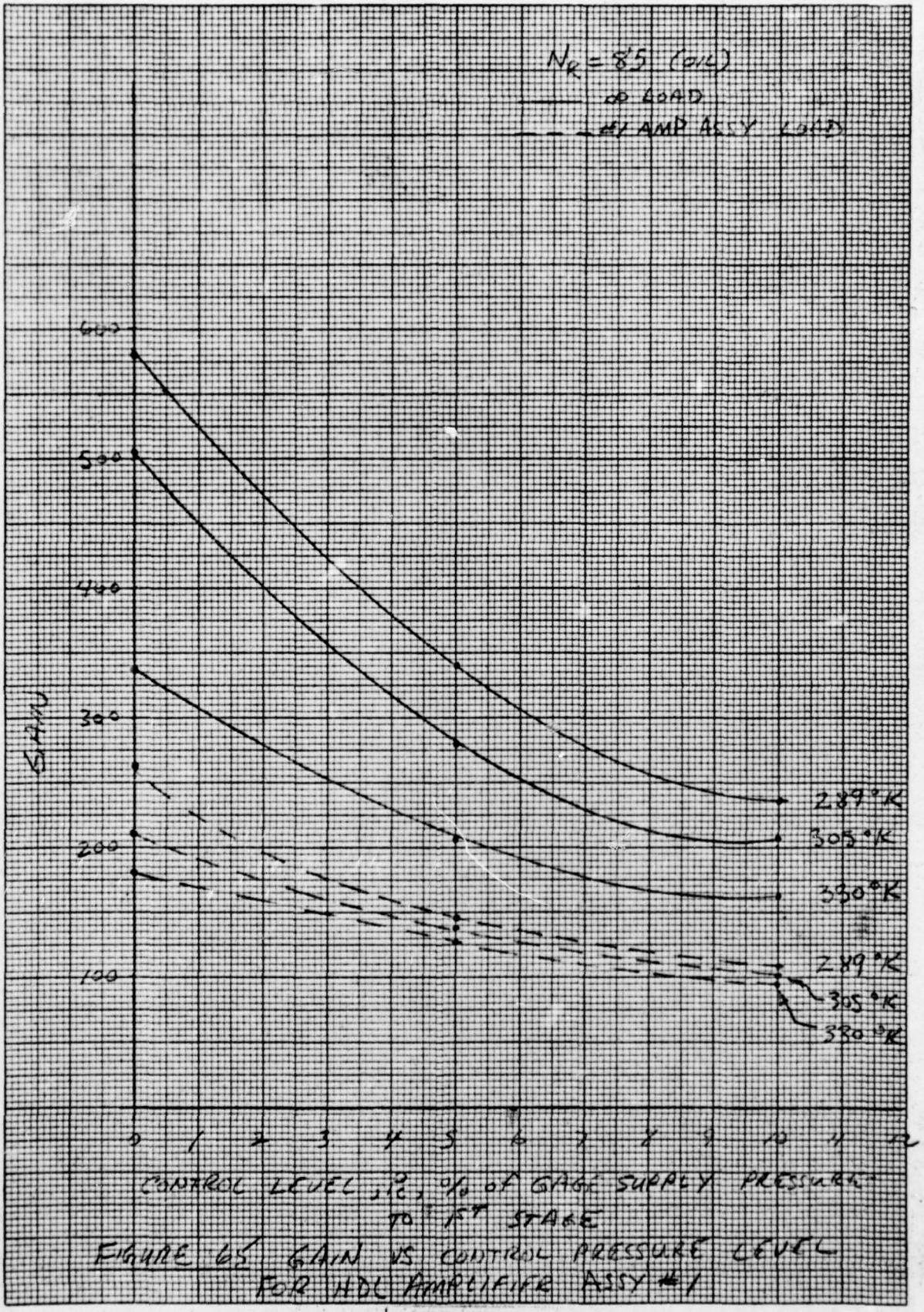



FIGURE 65 GAIN VS CONTROL PRESSURE LEVEL FOR HDC AMPLIFIER ASSY #1

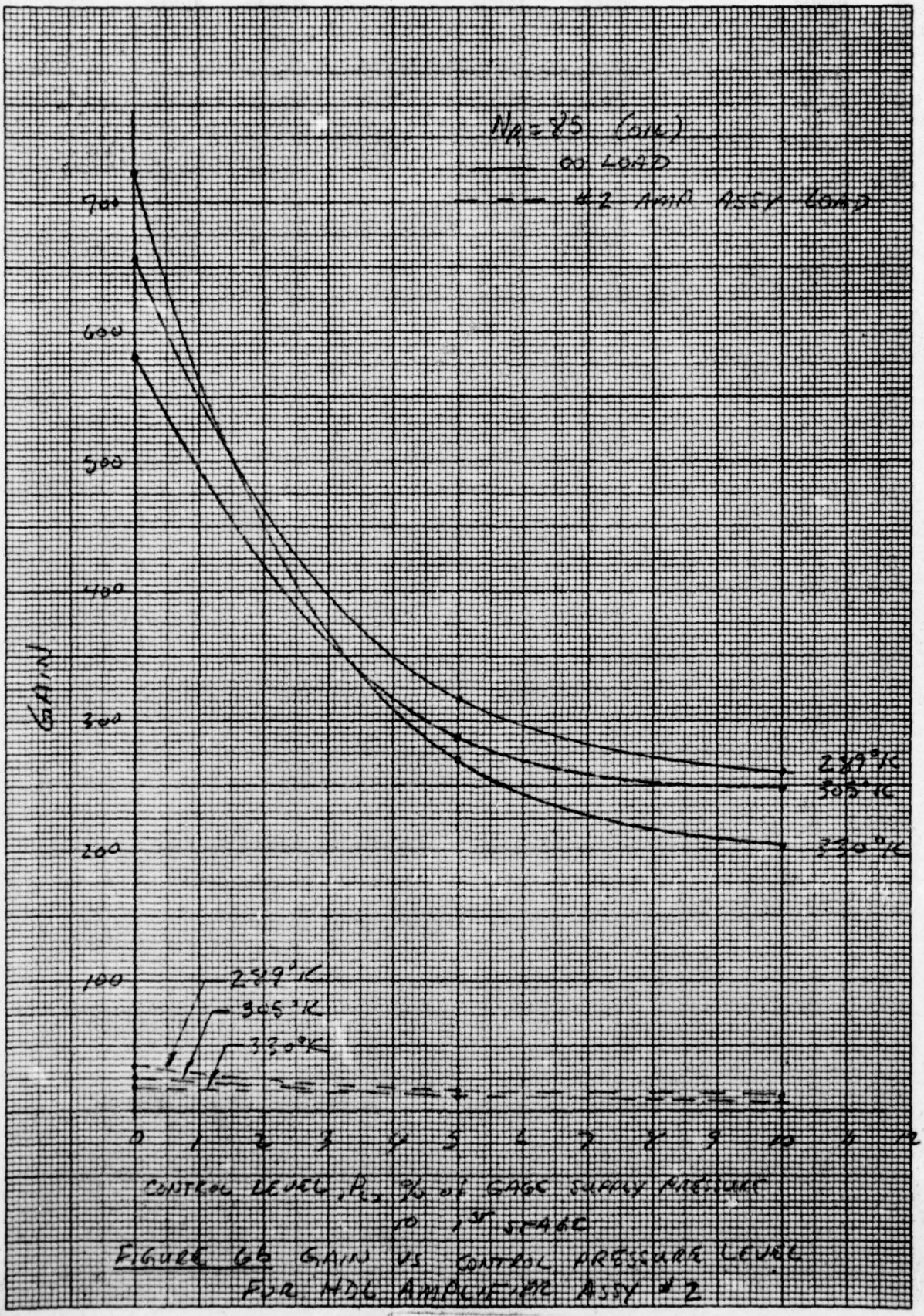



FIGURE 66 GAIN VS CONTROL PRESSURE LEVEL FOR NO6 AMPLIFIER ASSY # 2

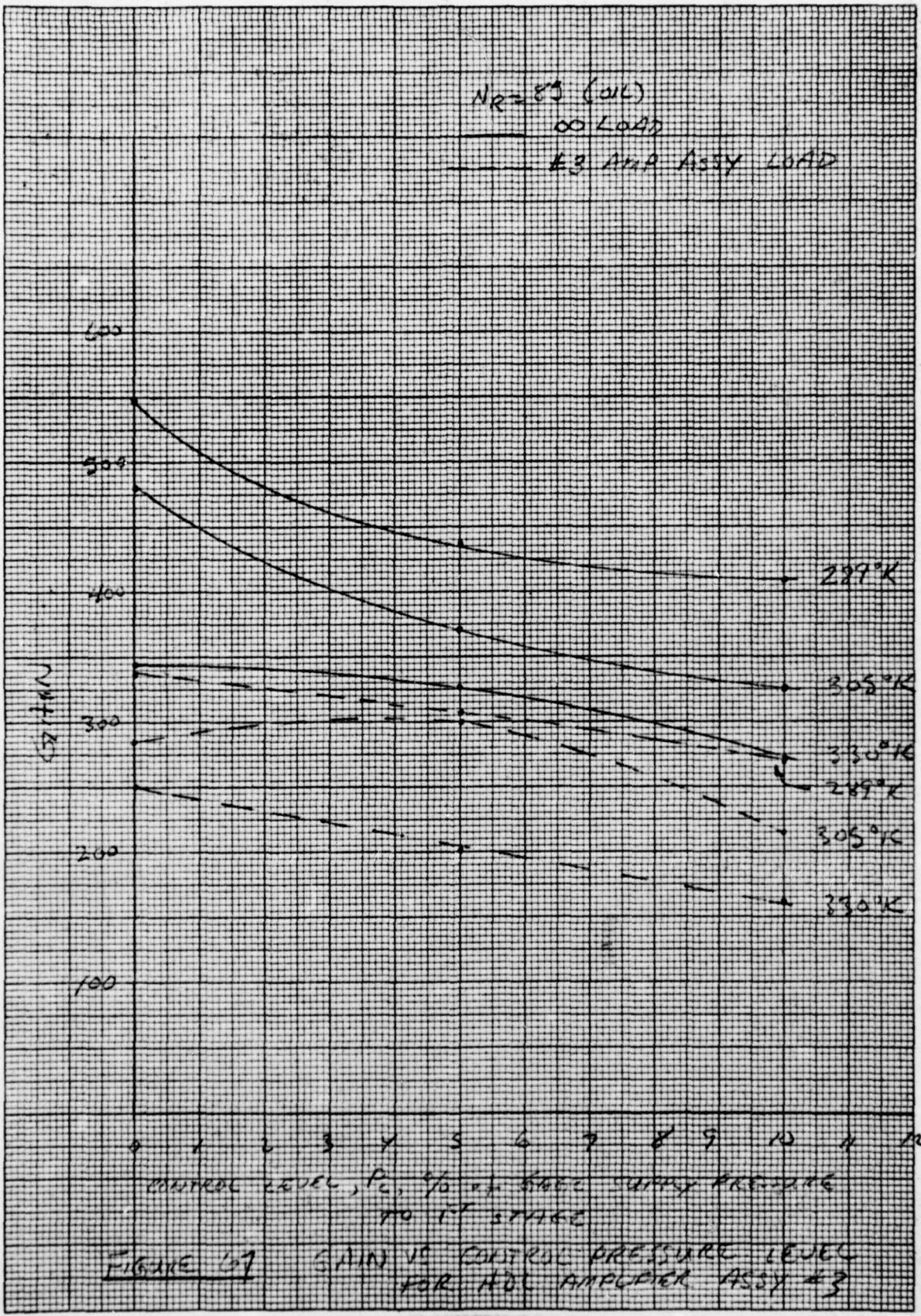



FIGURE 67 GAIN VS CONTROL PRESSURE LEVEL FOR HDL AMPLIFIER ASSY #3

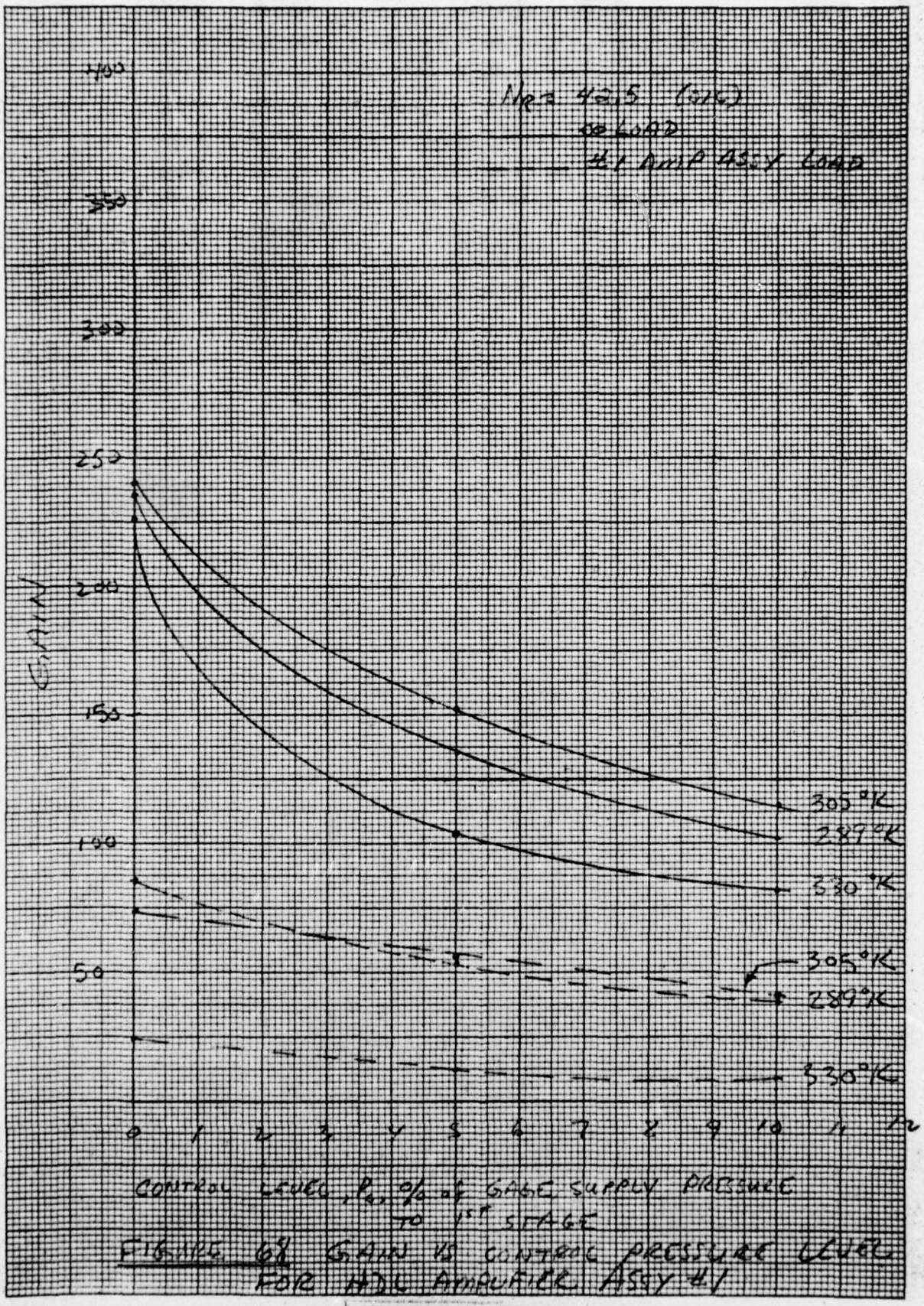



FIGURE 68 GAIN VS CONTROL PRESSURE LEVEL FOR HDLC AMPLIFIER ASSY #1

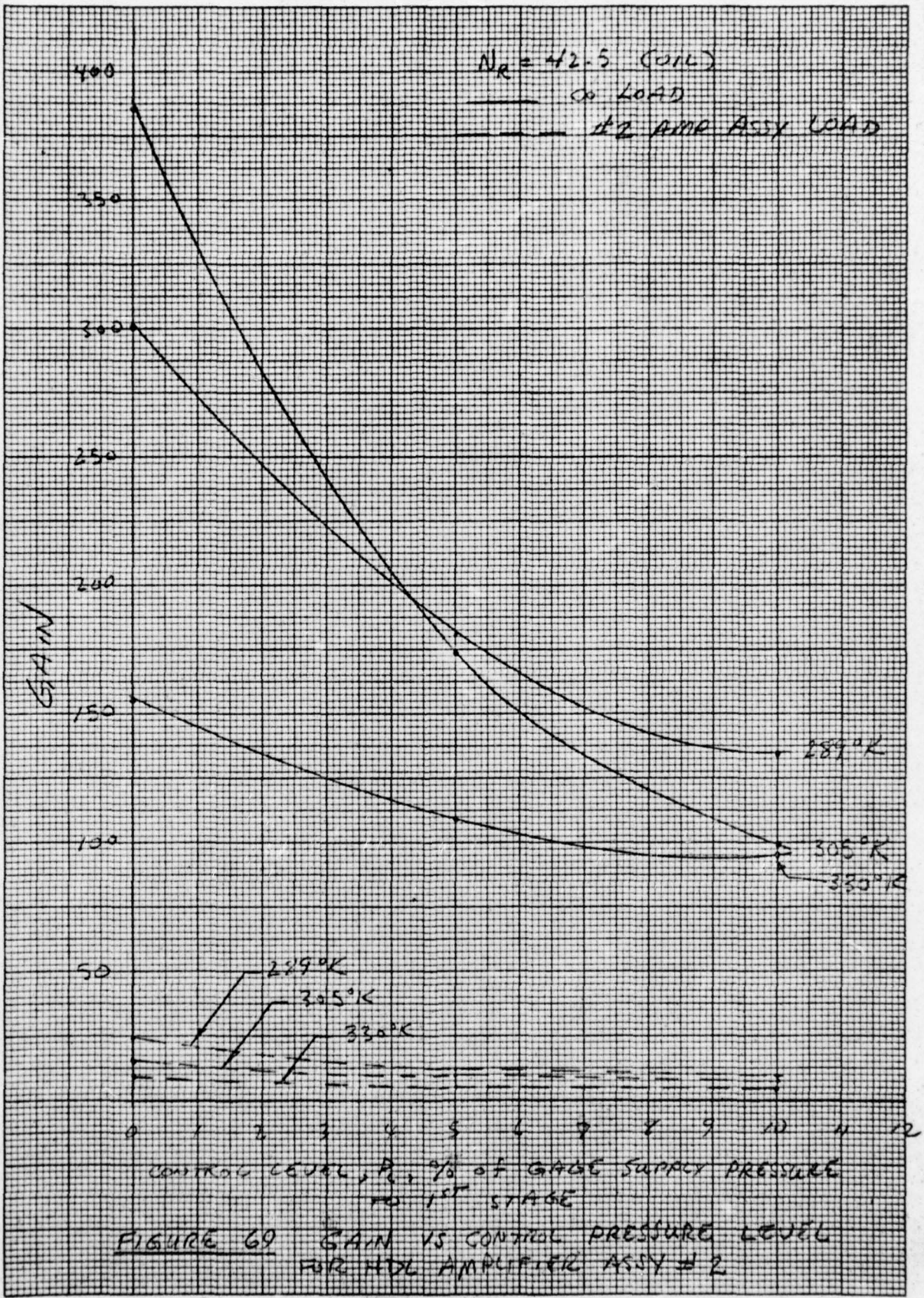



FIGURE 69 GAIN VS CONTROL PRESSURE LEVEL FOR HDL AMPLIFIER ASSY # 2

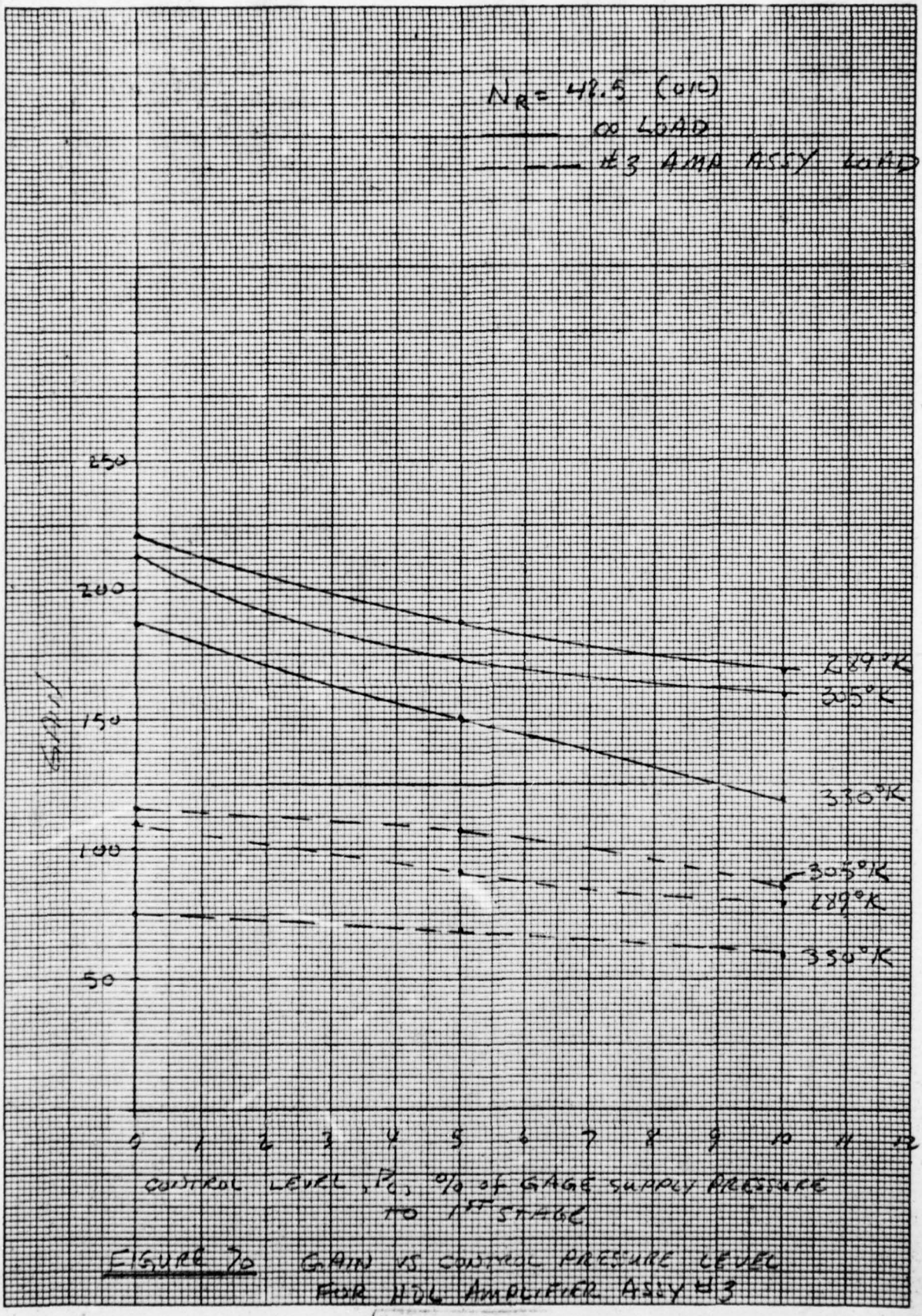



FIGURE 70 GAIN VS CONTROL PRESSURE LEVEL FOR HDL AMPLIFIER ASSY #3

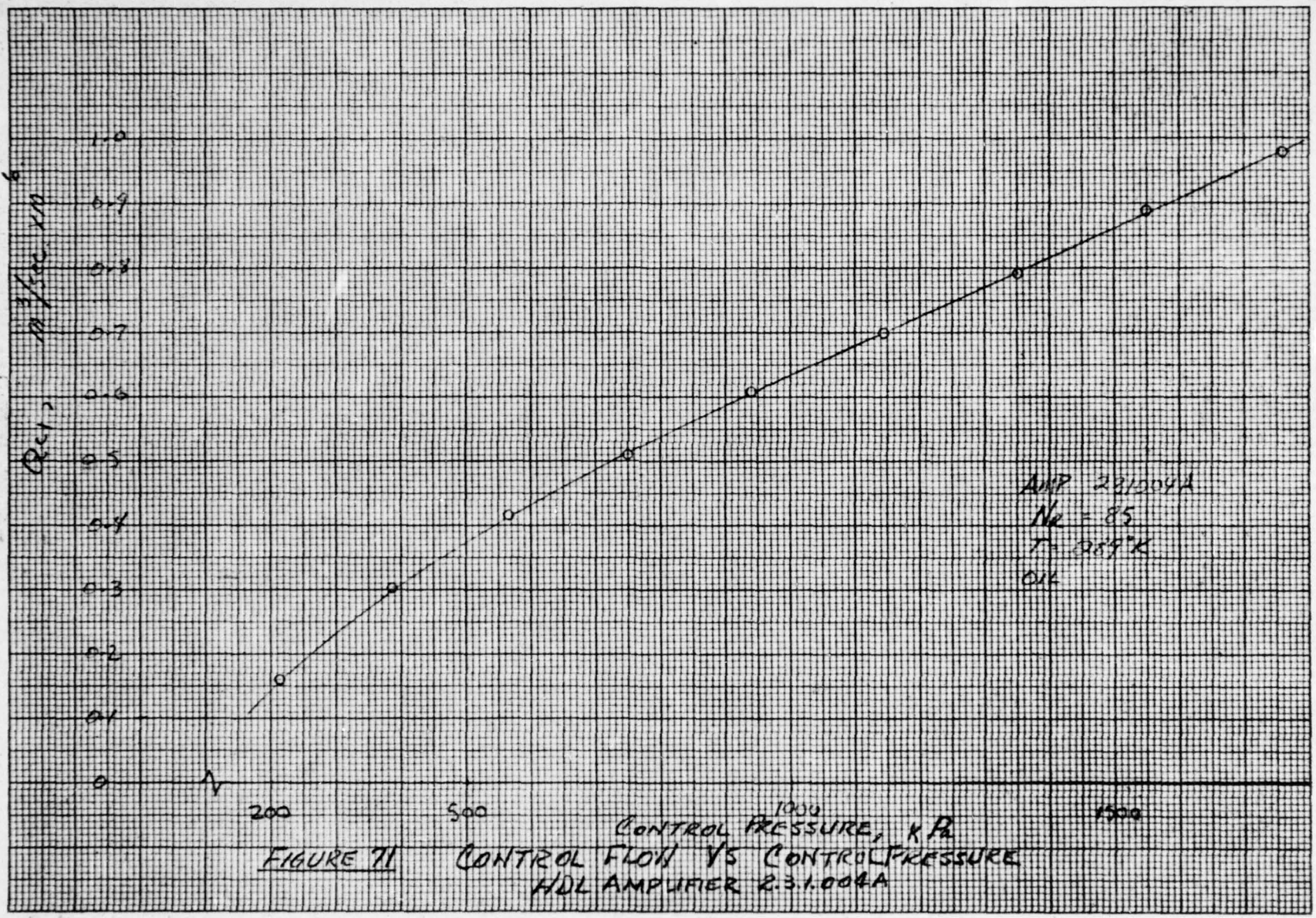



FIGURE 71 CONTROL FLOW VS CONTROL PRESSURE
HDL AMPLIFIER 2.3.1.004A

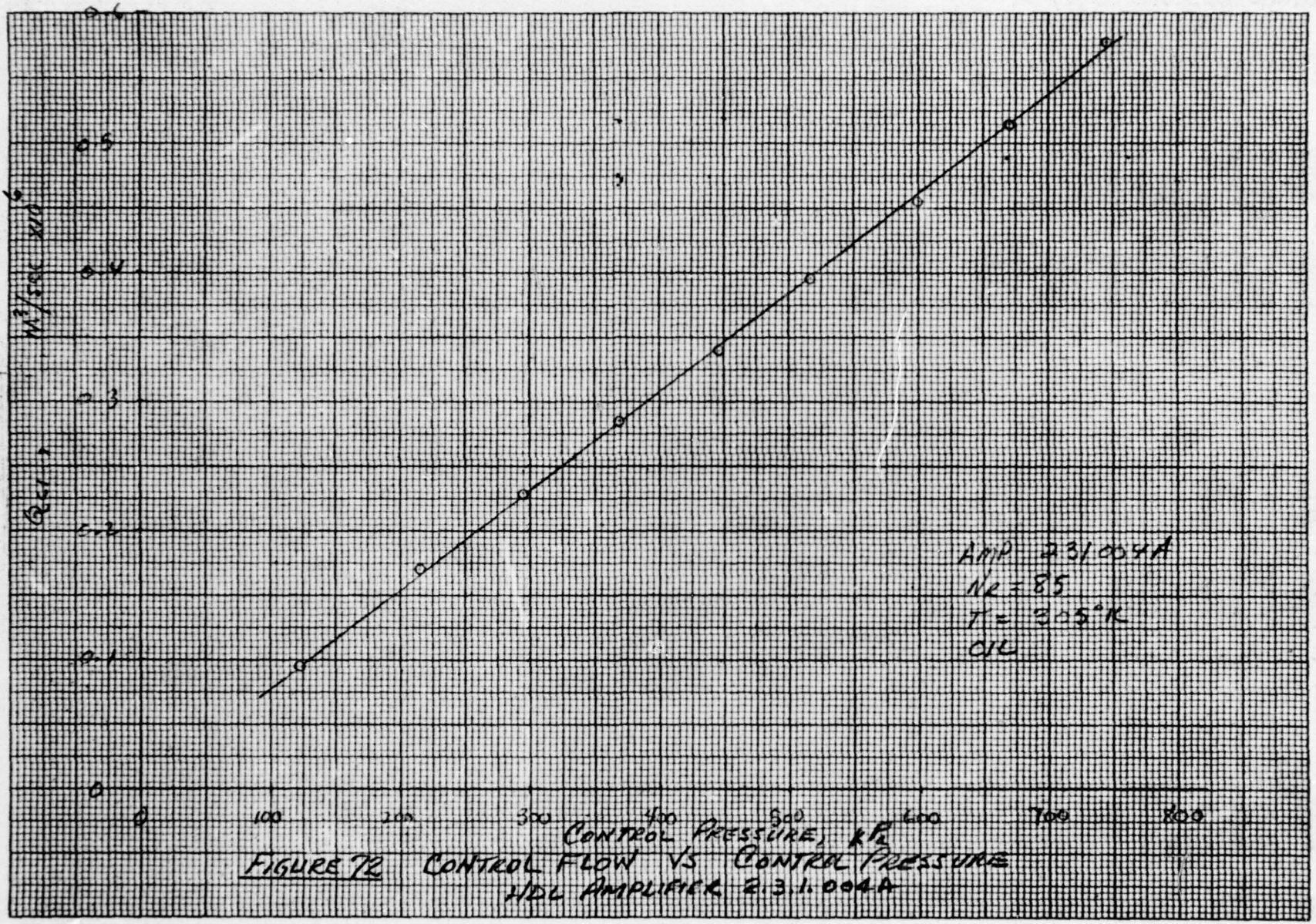



FIGURE 72 CONTROL FLOW VS CONTROL PRESSURE
2IDL AMPLIFIER 2.3.1.004A

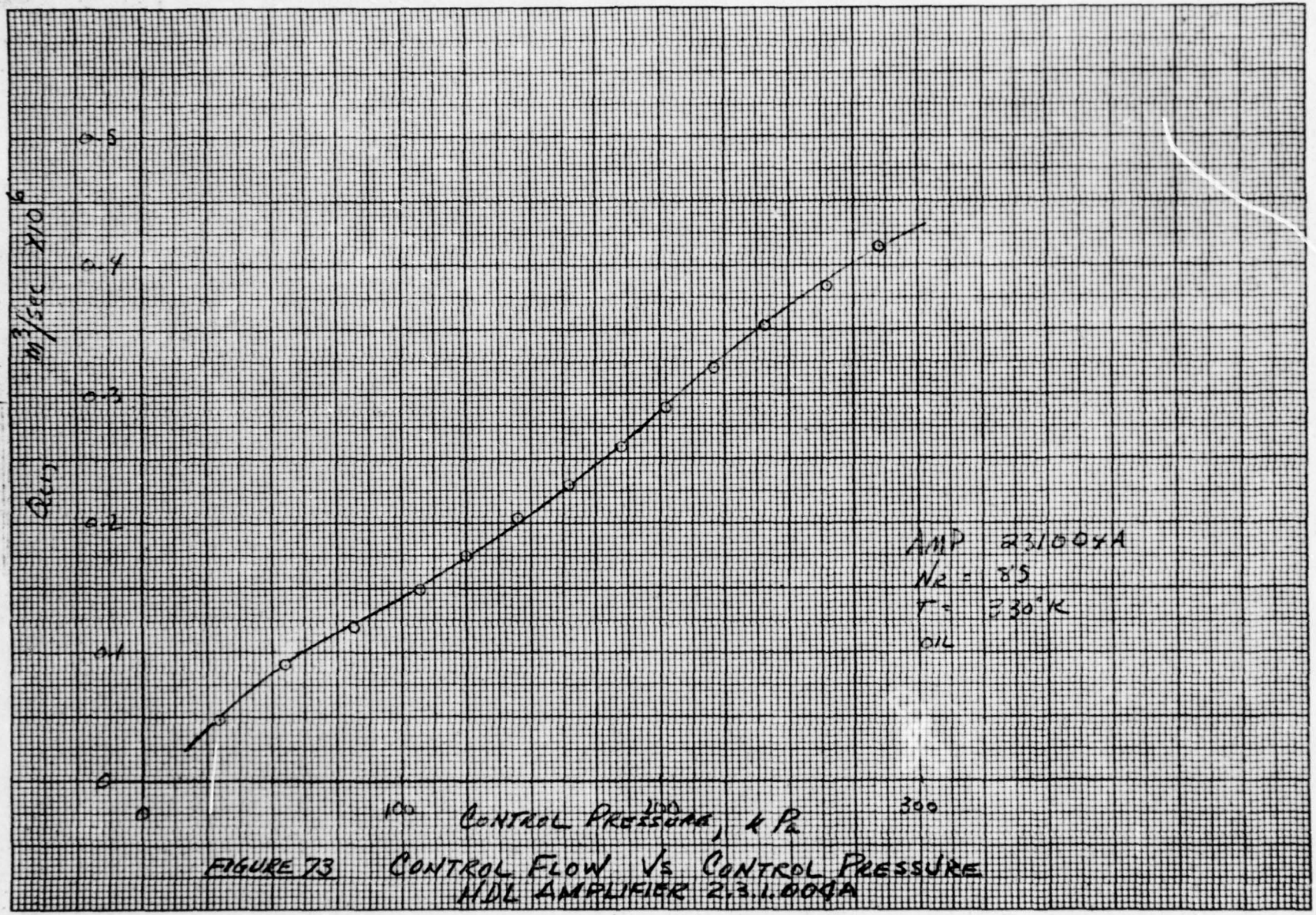



FIGURE 73 CONTROL FLOW VS CONTROL PRESSURE
AIDL AMPLIFIER 2-3.1.0004A

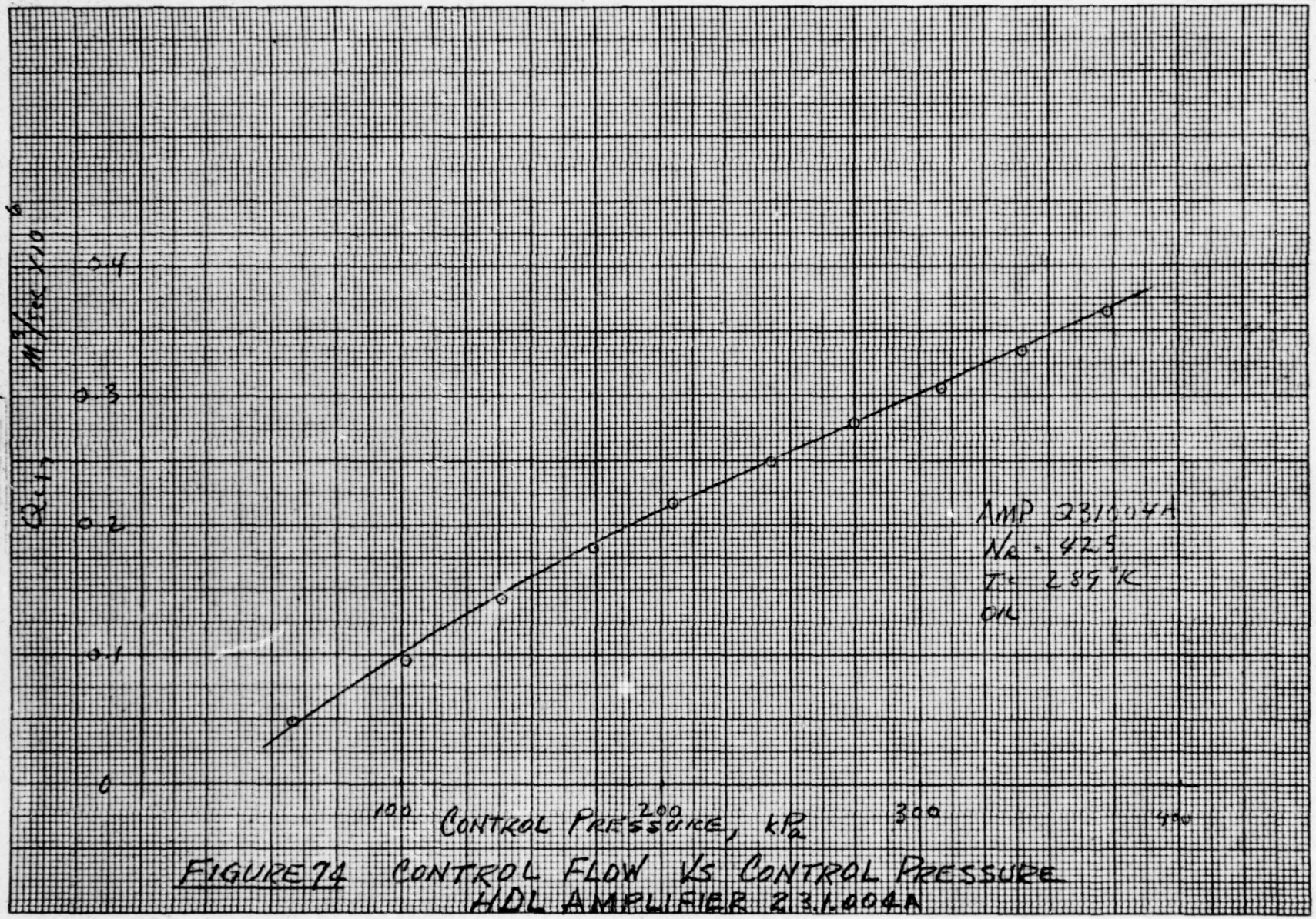



FIGURE 74 CONTROL FLOW VS CONTROL PRESSURE
HDL AMPLIFIER 23.1004A

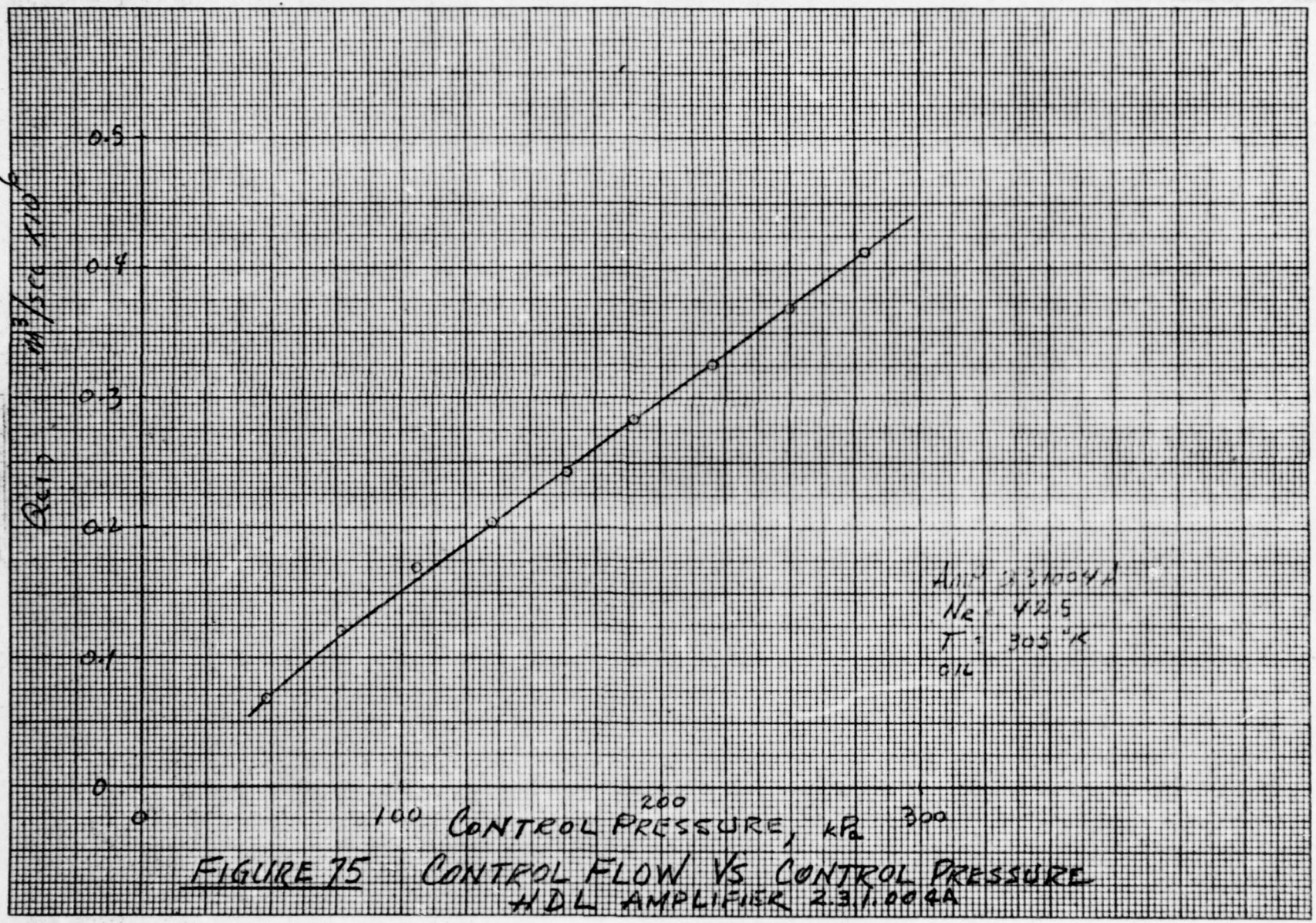



FIGURE 75 CONTROL FLOW VS CONTROL PRESSURE
HDL AMPLIFIER 2.31.004A

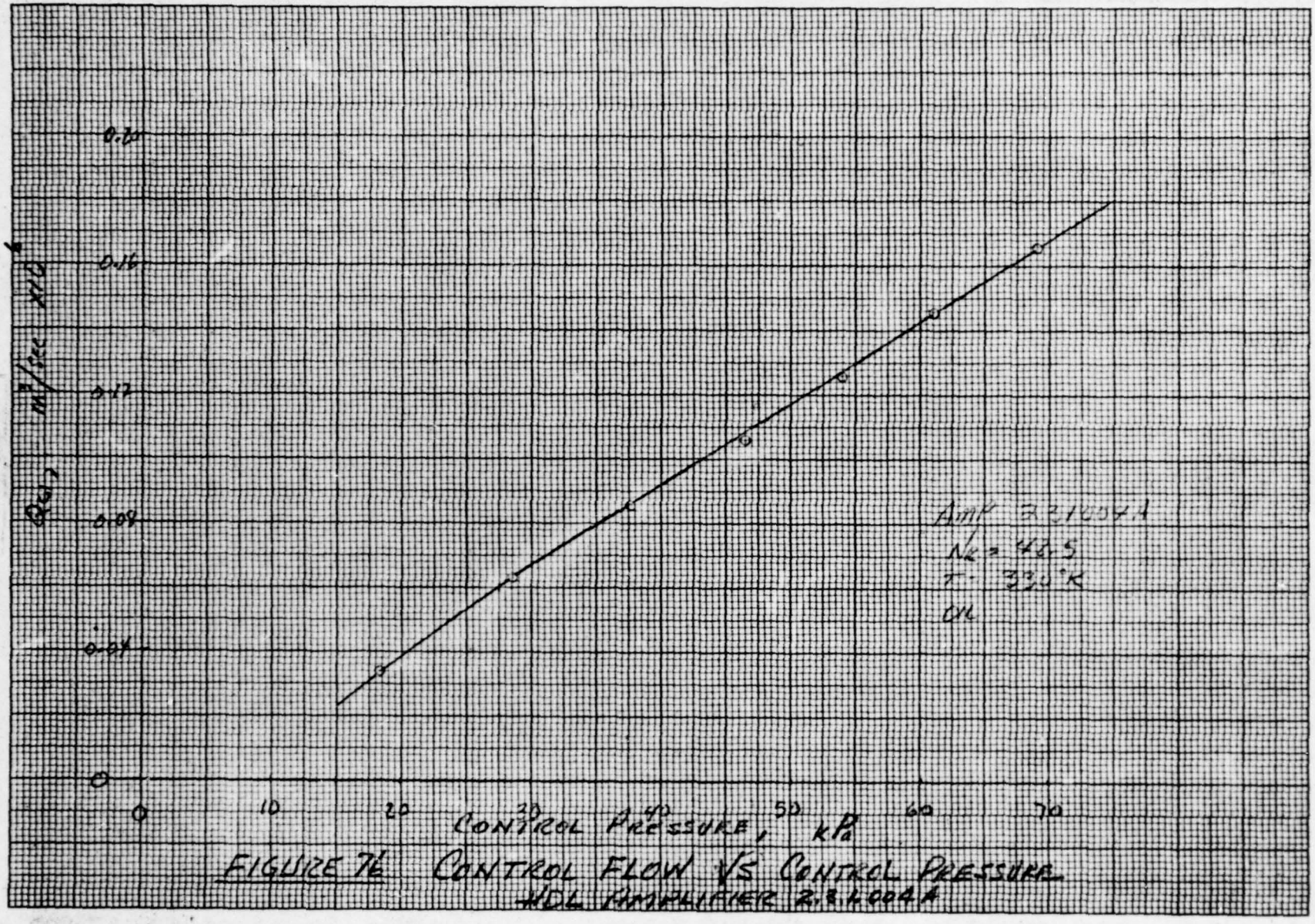



FIGURE 76 CONTROL FLOW VS CONTROL PRESSURE
HDL AMPLIFIER 2.2 K004.1

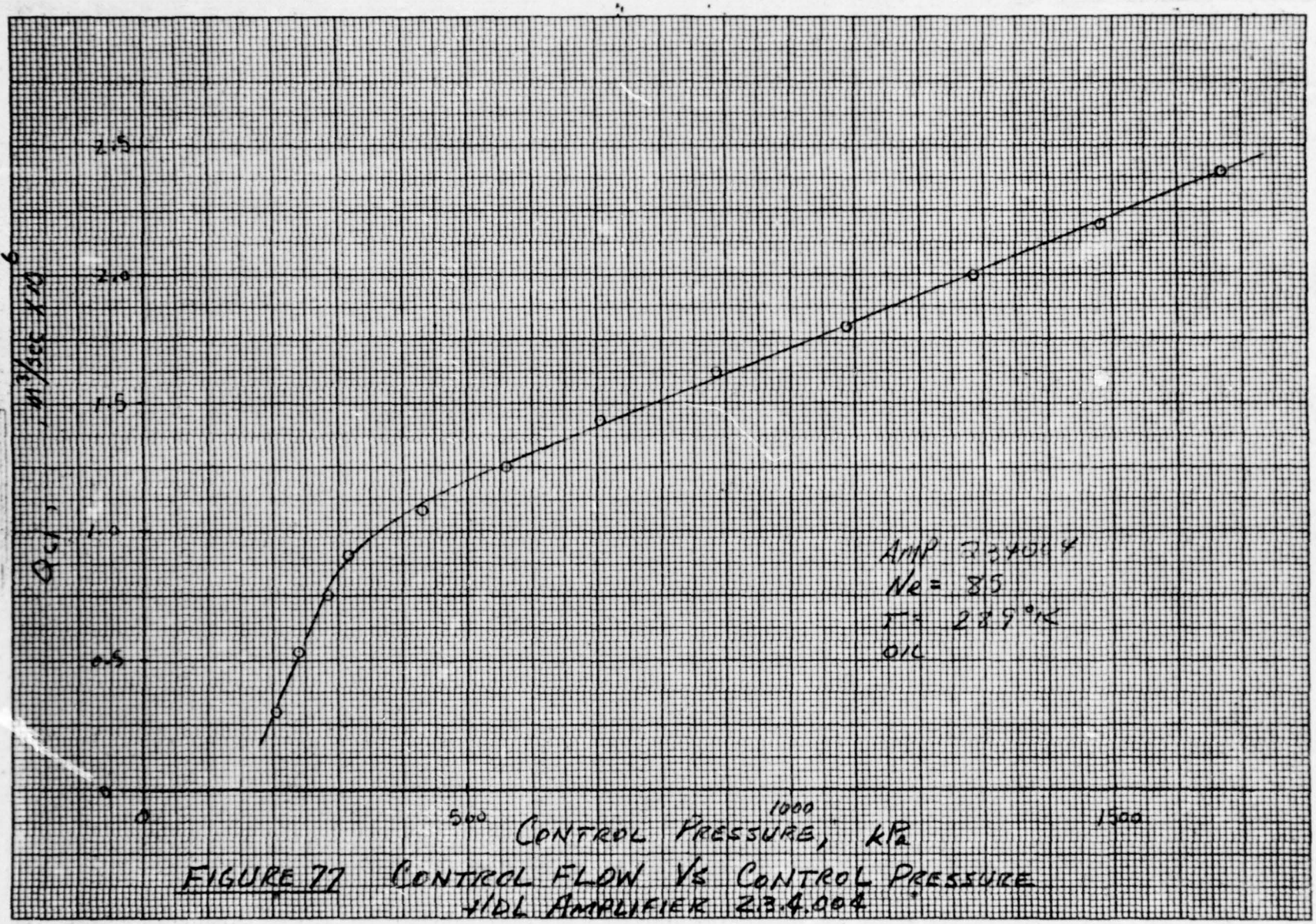



FIGURE 77 CONTROL FLOW VS CONTROL PRESSURE
VIDL AMPLIFIER 23.4.004

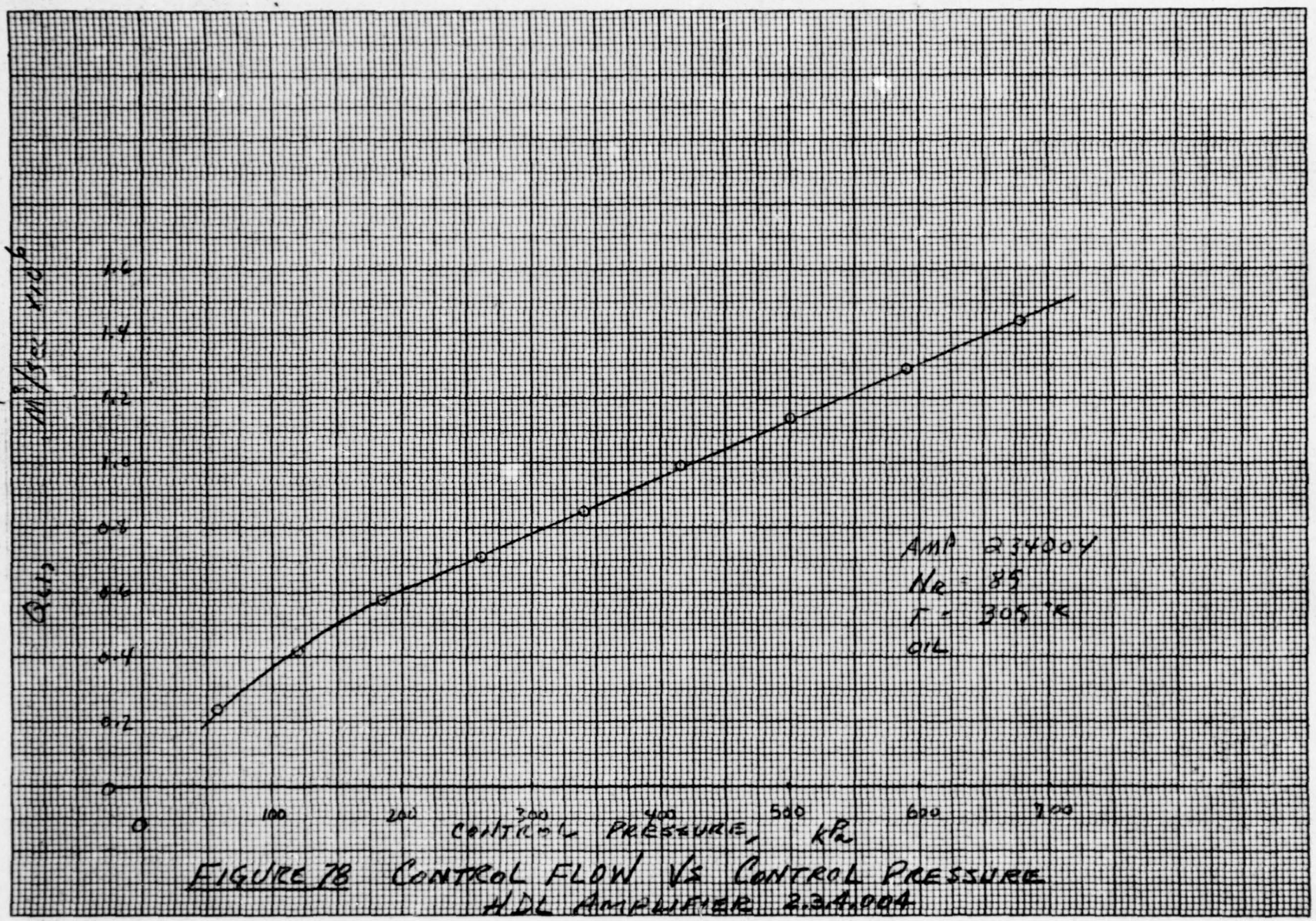



FIGURE 78 CONTROL FLOW VS CONTROL PRESSURE
MDL AMPLIFIER 23400Y

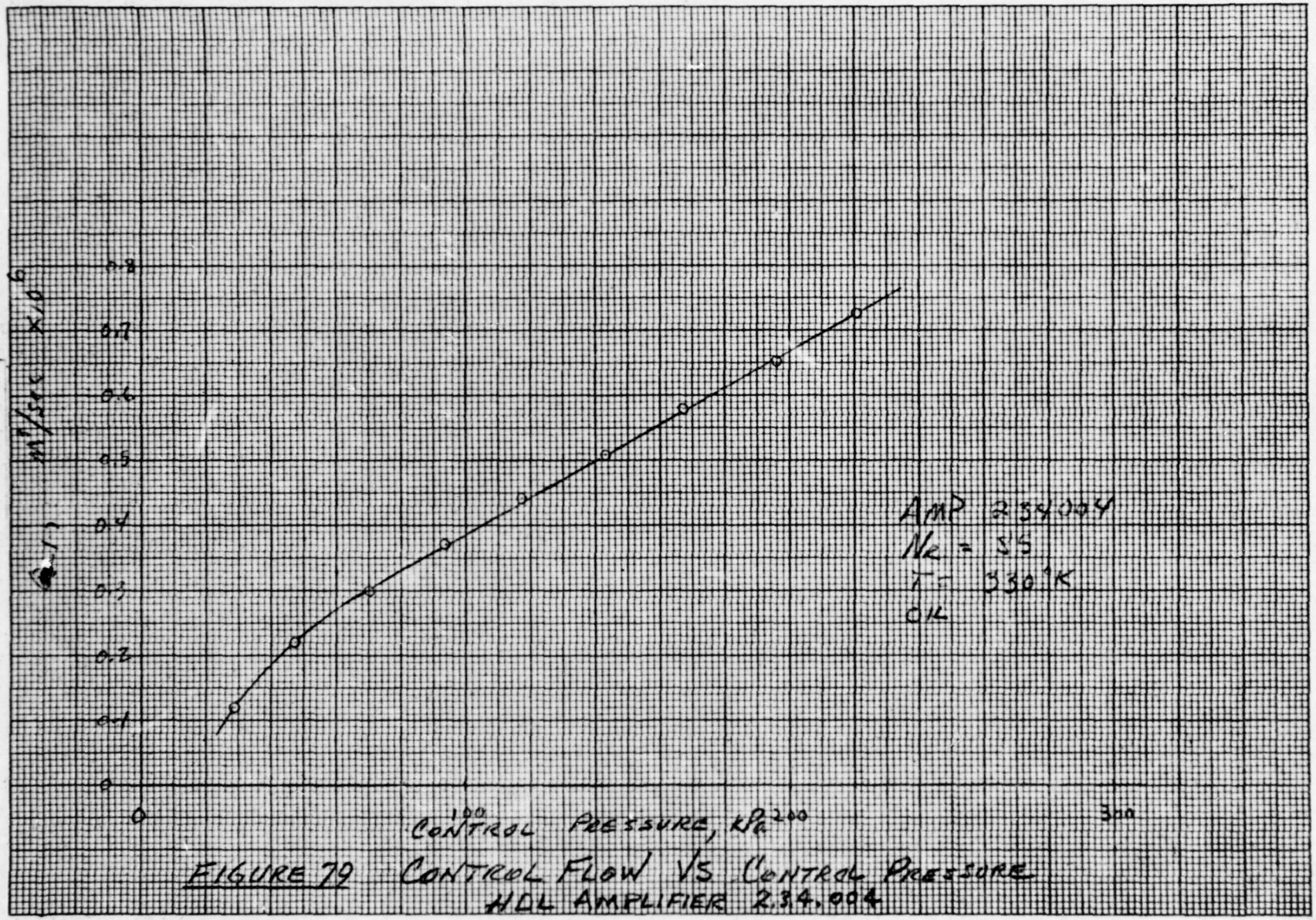



FIGURE 79 CONTROL FLOW VS CONTROL PRESSURE
HOL AMPLIFIER 2.34.004

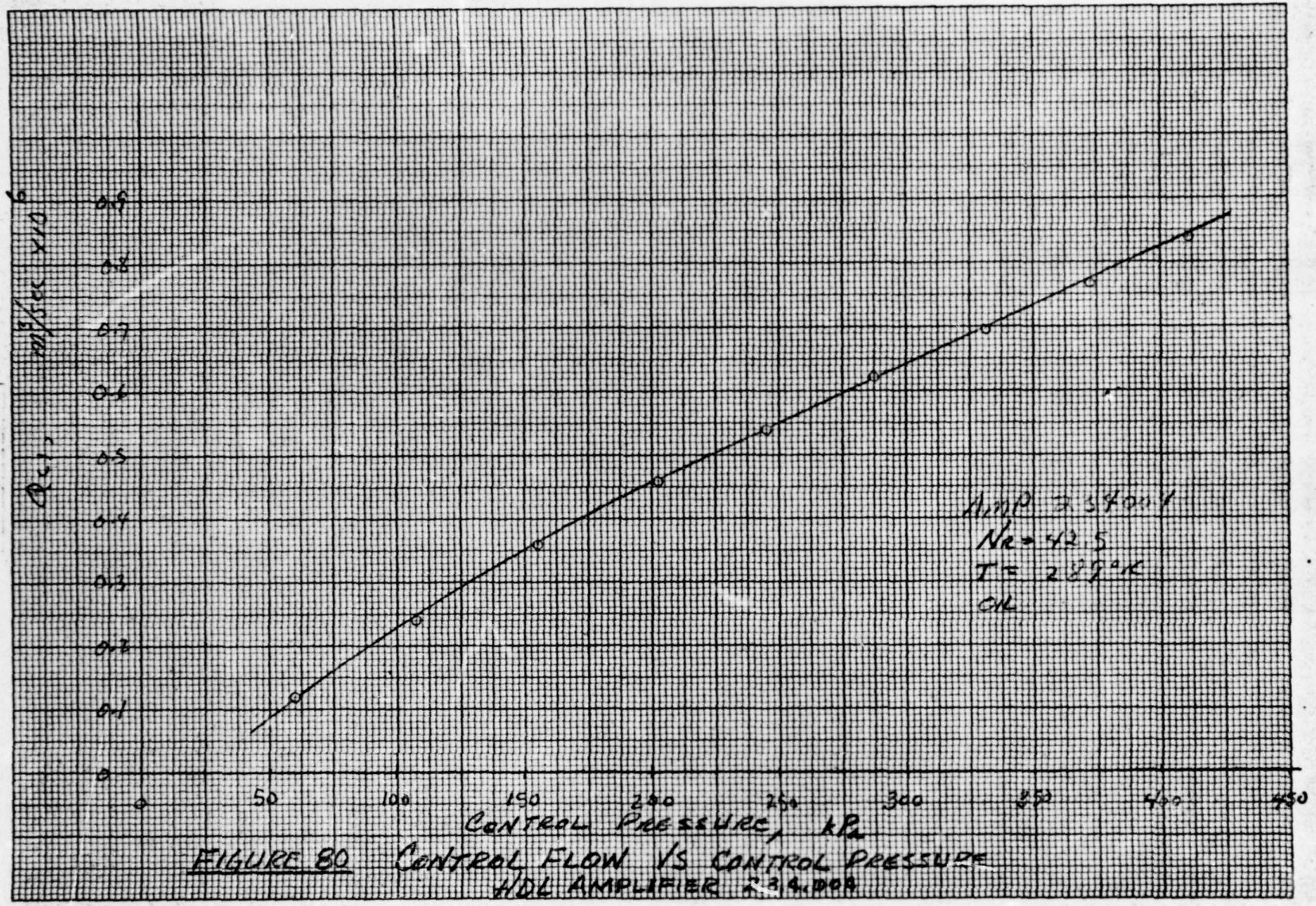



FIGURE 80 CONTROL FLOW VS CONTROL PRESSURE
WOL AMPLIFIER 234.008

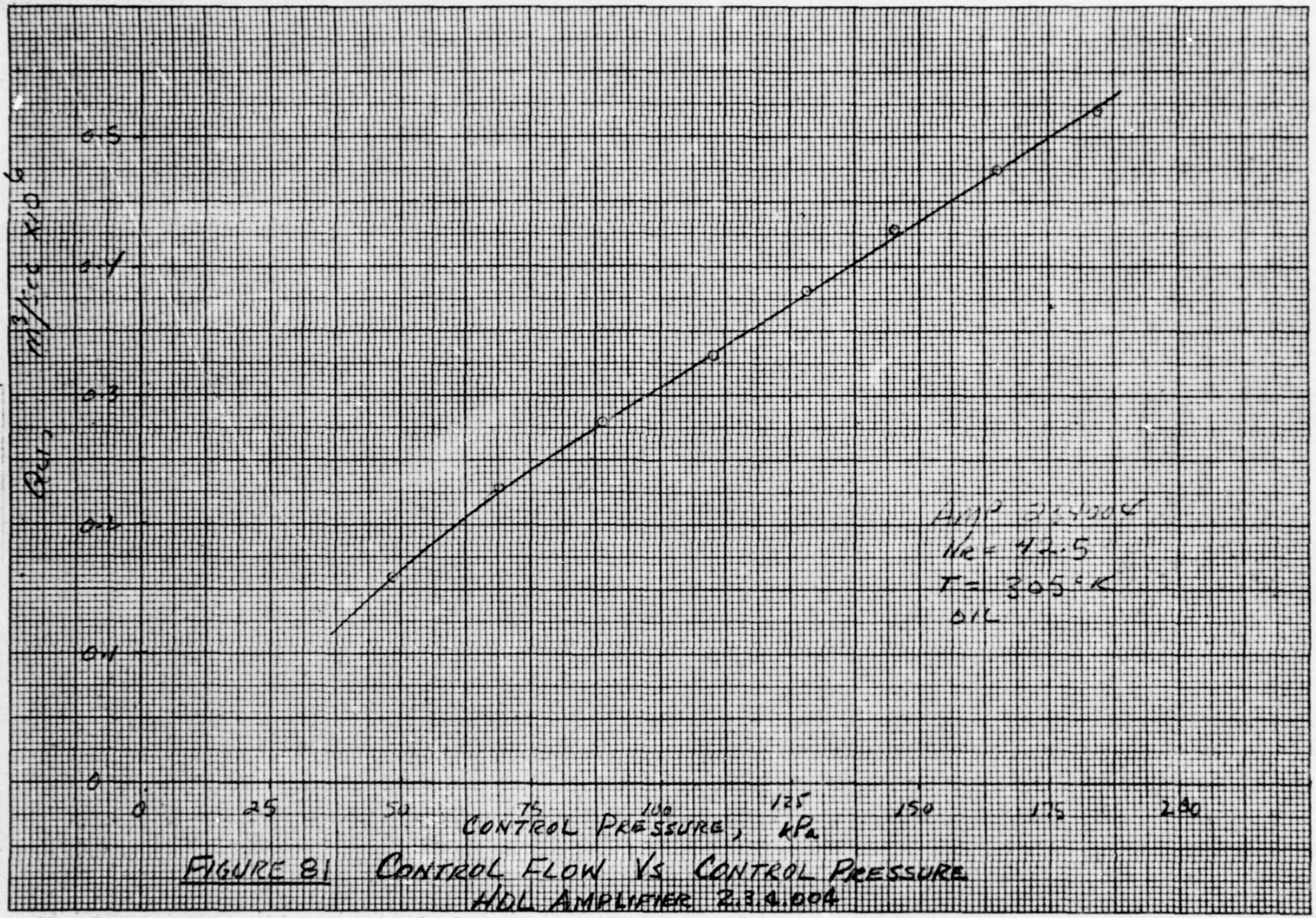



FIGURE 81 CONTROL FLOW VS CONTROL PRESSURE
HDL AMPLIFIER 2.3.4.004

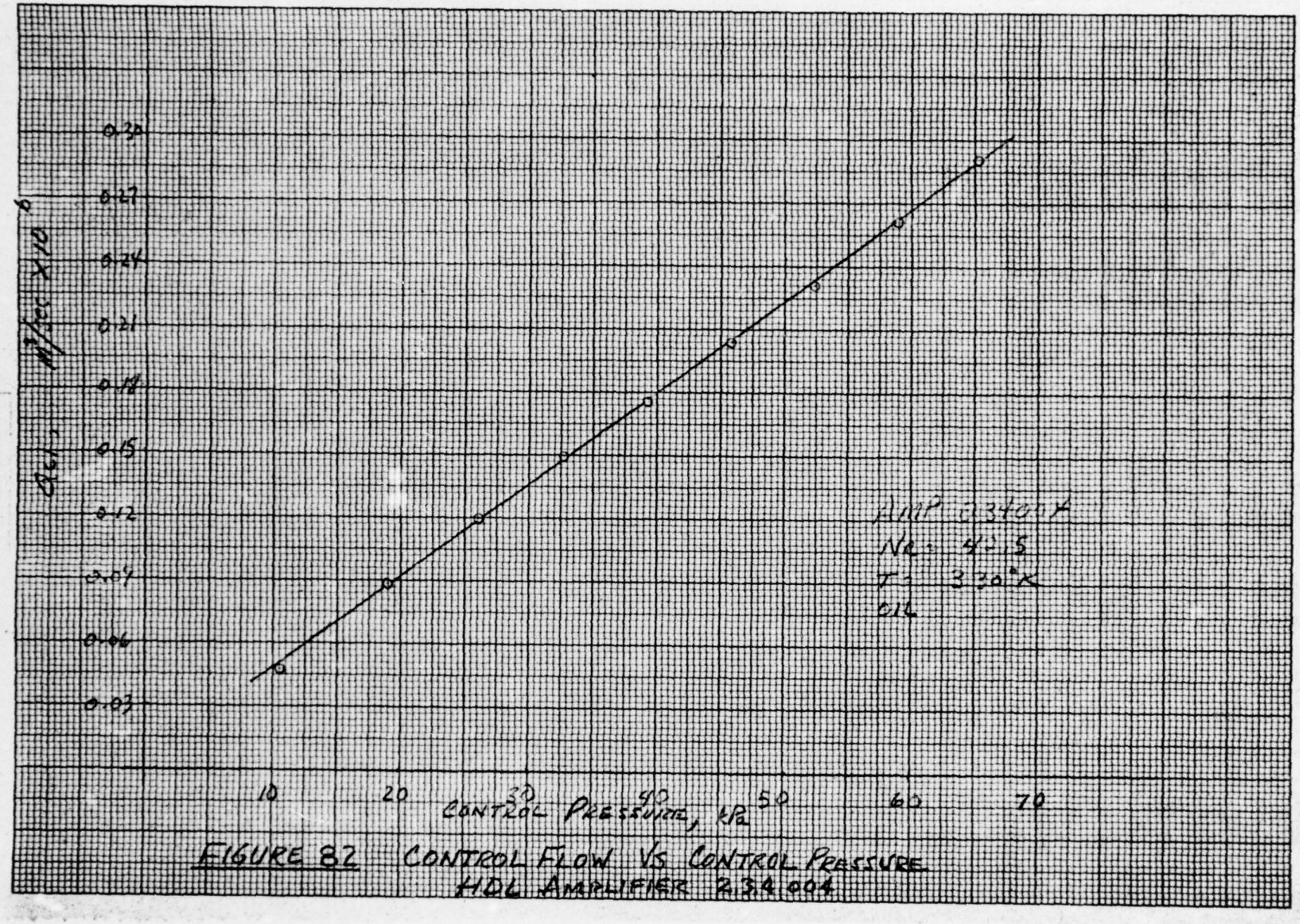



FIGURE 82 CONTROL FLOW VS CONTROL PRESSURE
HDL AMPLIFIER 234004

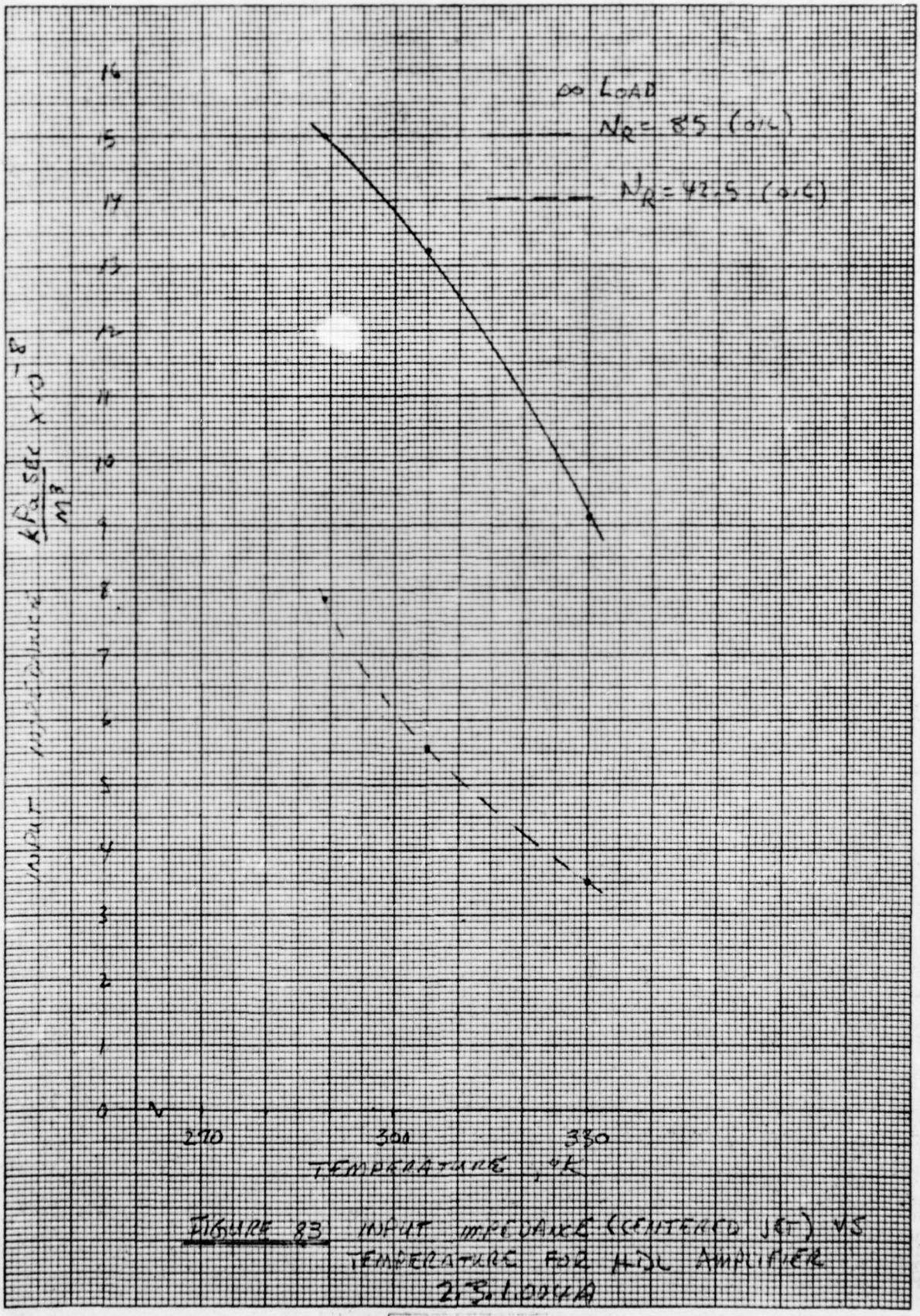



FIGURE 83 INPUT IMPEDANCE (CENTERED JET) VS TEMPERATURE FOR HDL AMPLIFIER 25 Ω LOADA

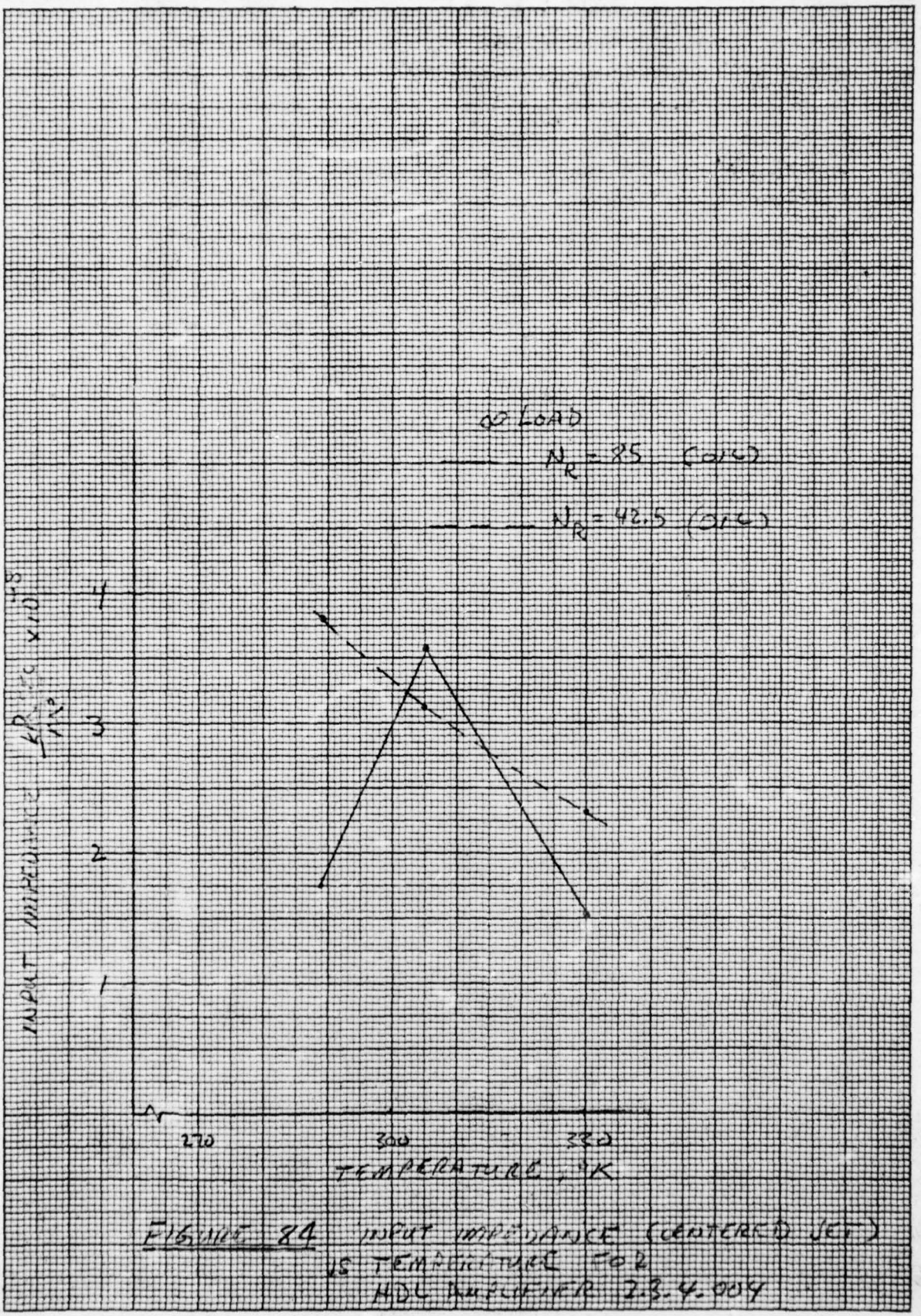



FIGURE 84 INPUT IMPEDANCE (CENTERED SET) VS TEMPERATURE FOR HDL INVERTER 2.3.4.004

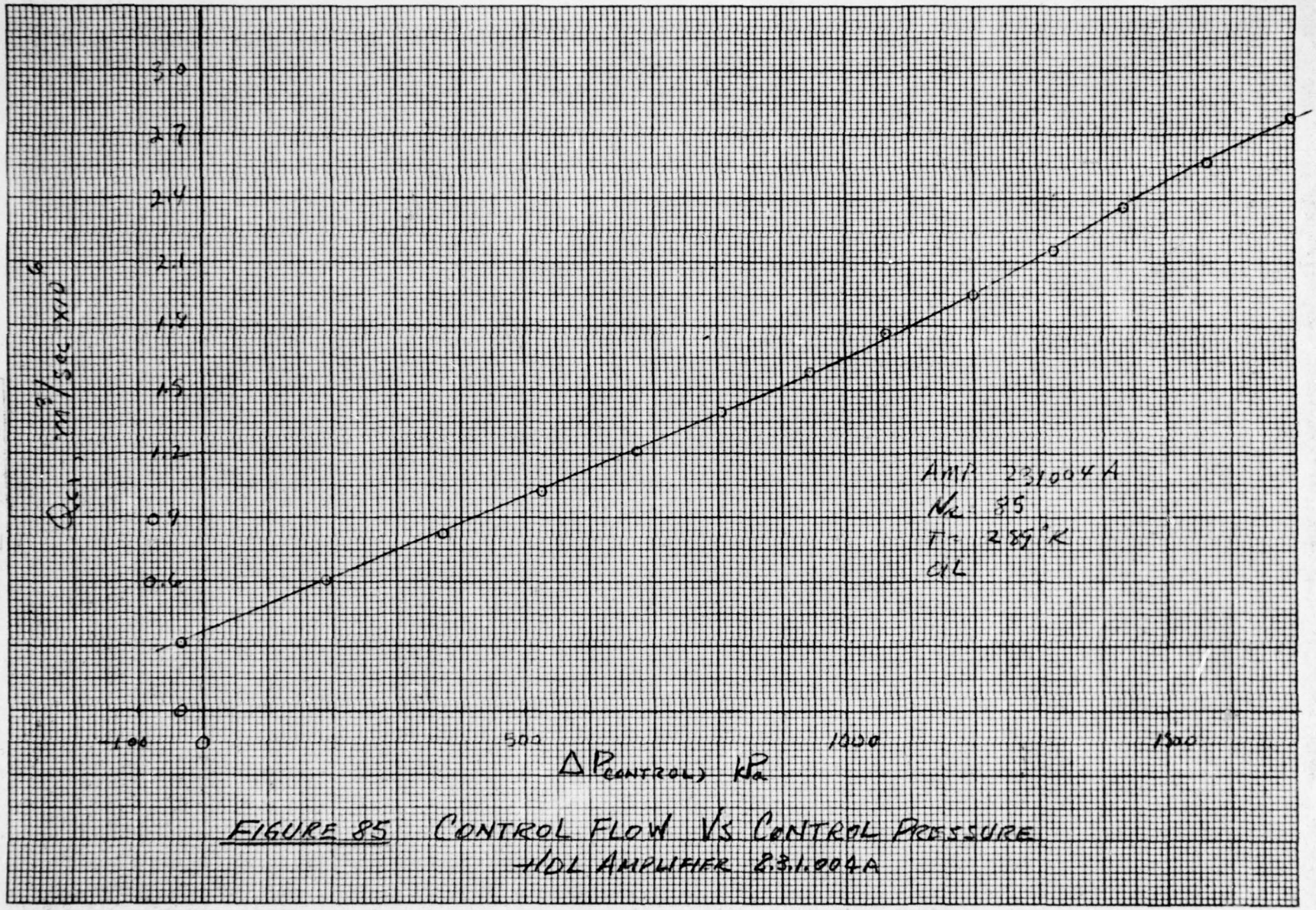



FIGURE 85 CONTROL FLOW VS CONTROL PRESSURE
HDL AMPLIFIER 2.31.004A

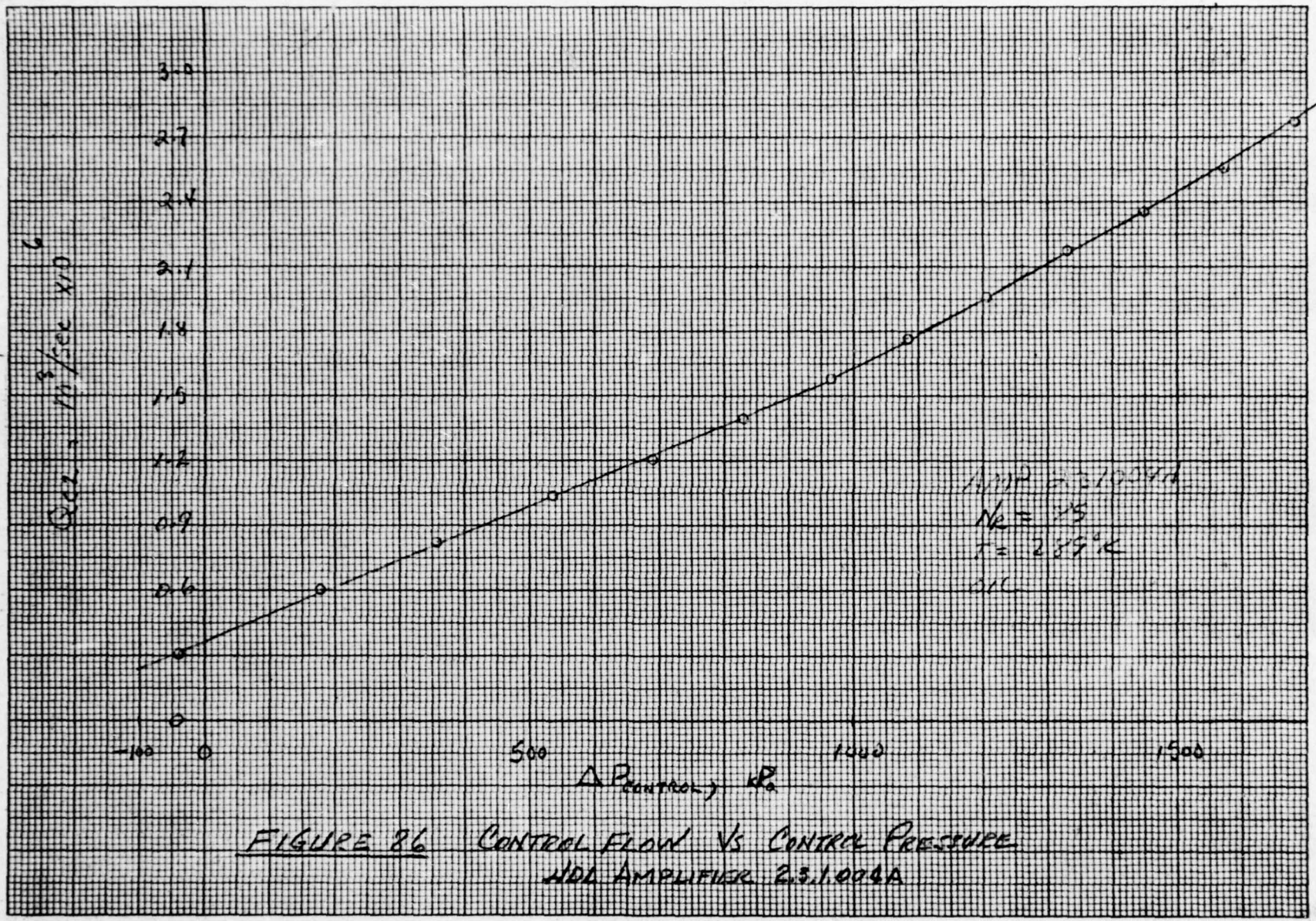



FIGURE 86 CONTROL FLOW VS CONTROL PRESSURE
WDL AMPLIFIER 2.3.1.004A

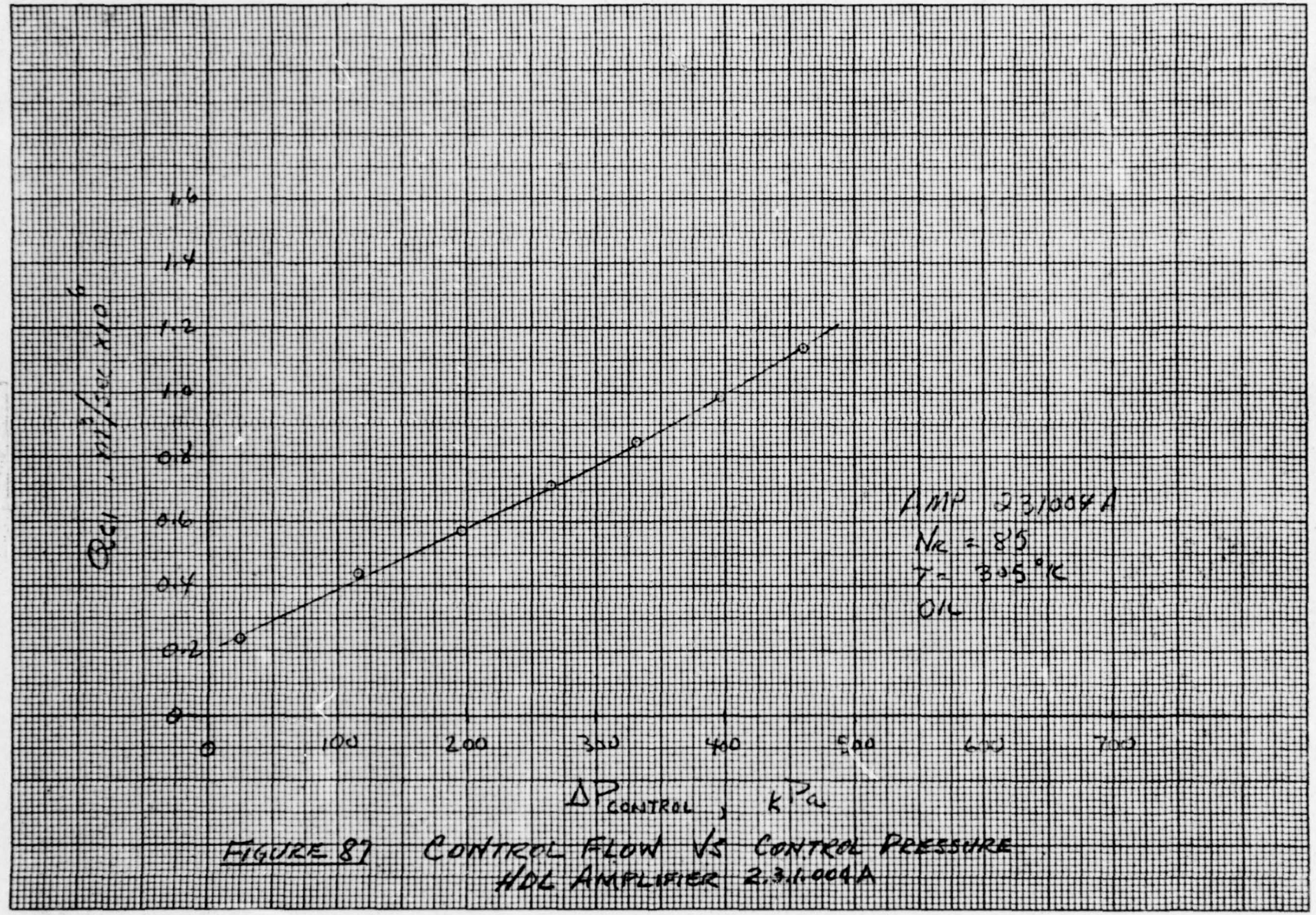



FIGURE 87 CONTROL FLOW VS CONTROL PRESSURE
HDL AMPLIFIER 2.3.1.004A

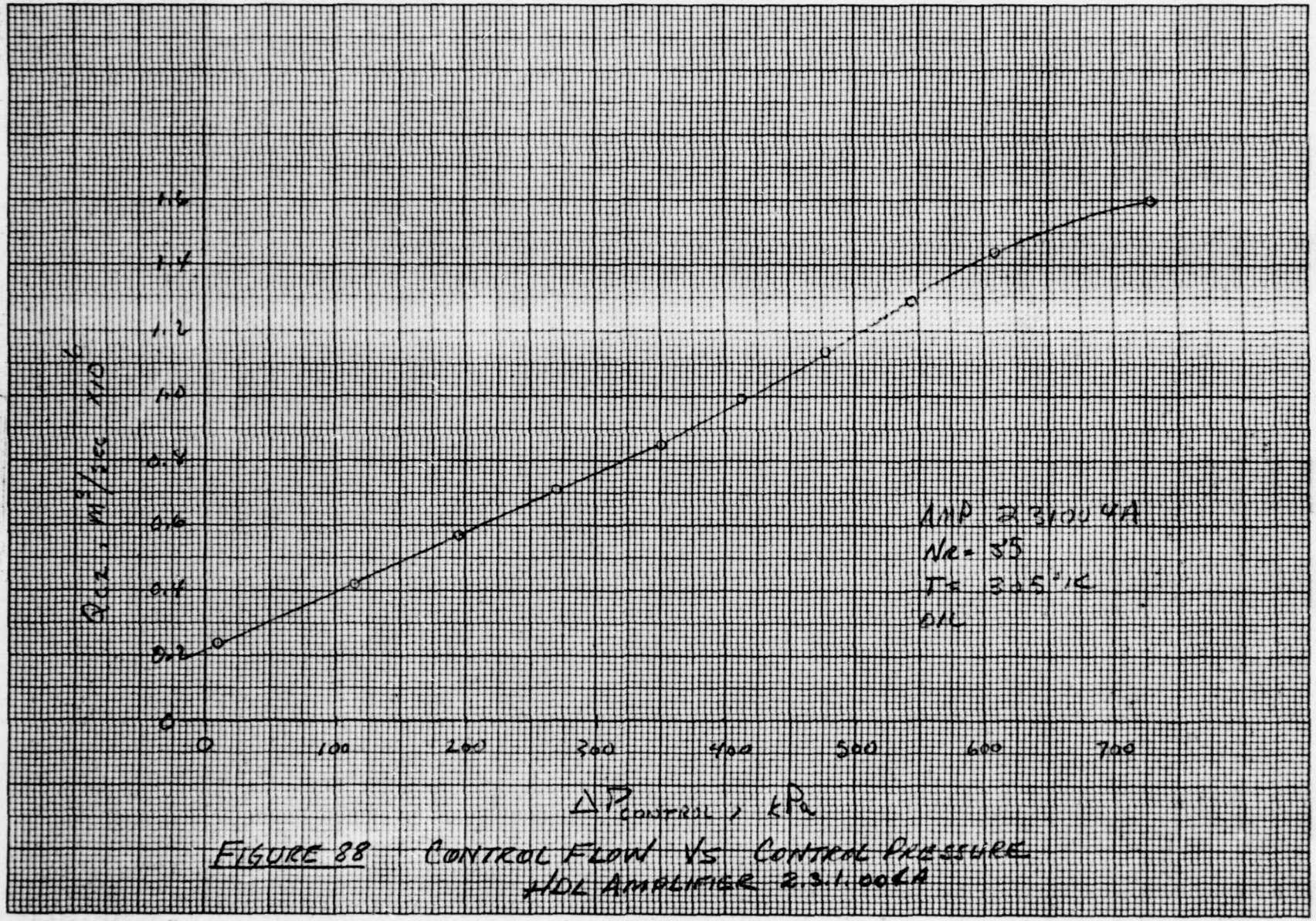



FIGURE 88 - CONTROL FLOW VS CONTROL PRESSURE
HDL AMPLIFIER 23.1.004A

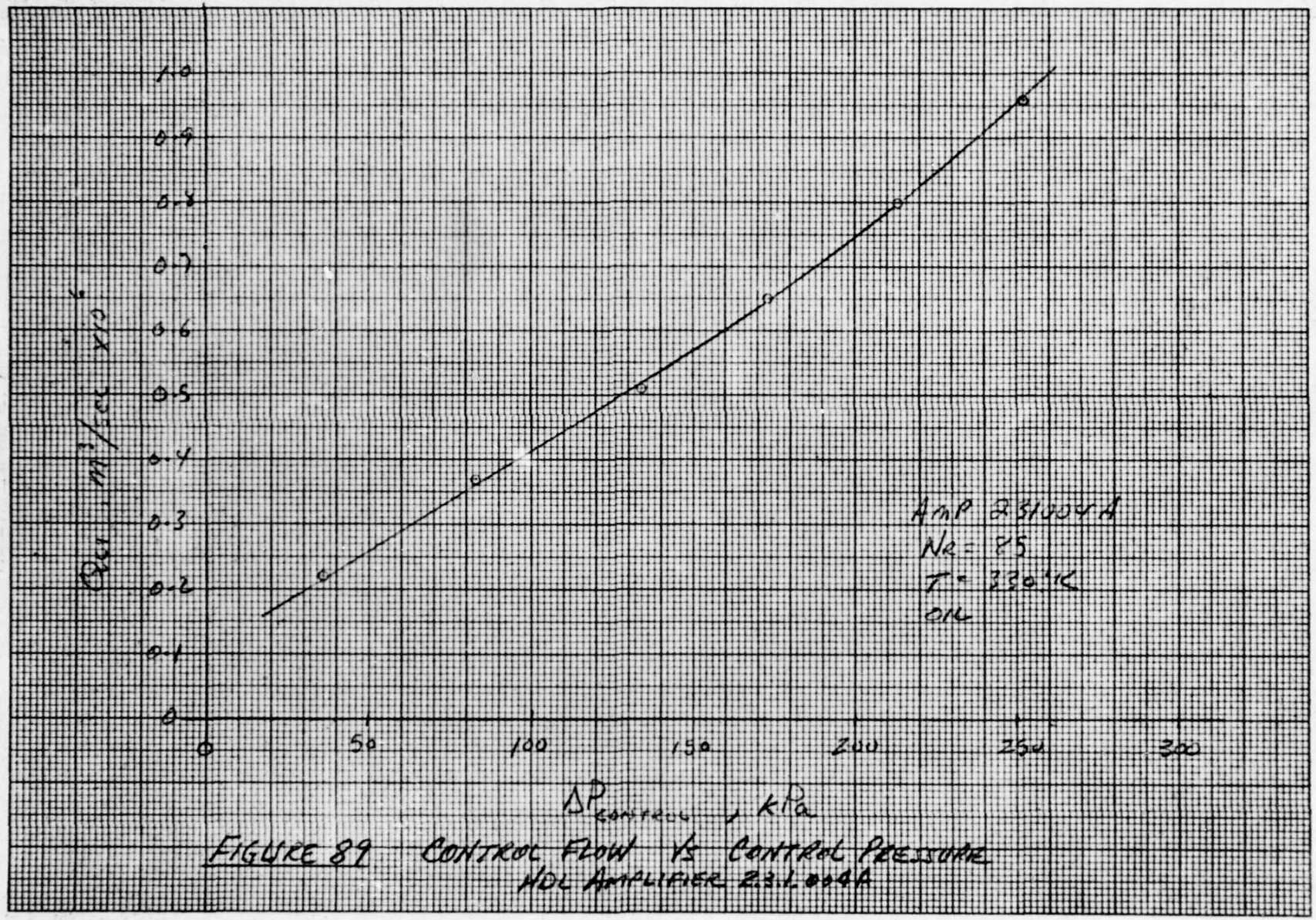



FIGURE 89 CONTROL FLOW VS CONTROL PRESSURE
MDL AMPLIFIER 2.31.004A

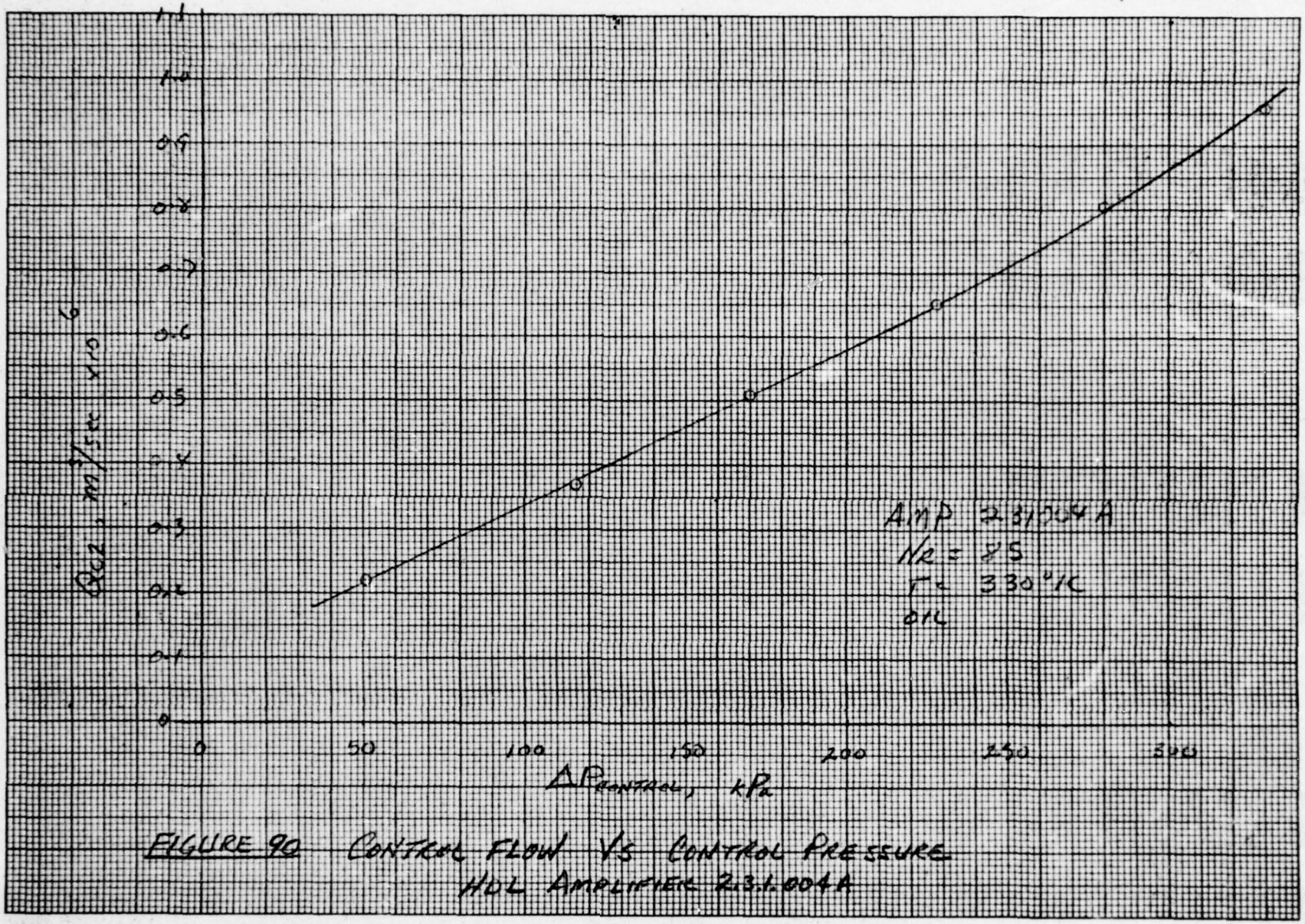



FIGURE 90 CONTROL FLOW VS CONTROL PRESSURE
HOL AMPLIFIER 2.31.004A

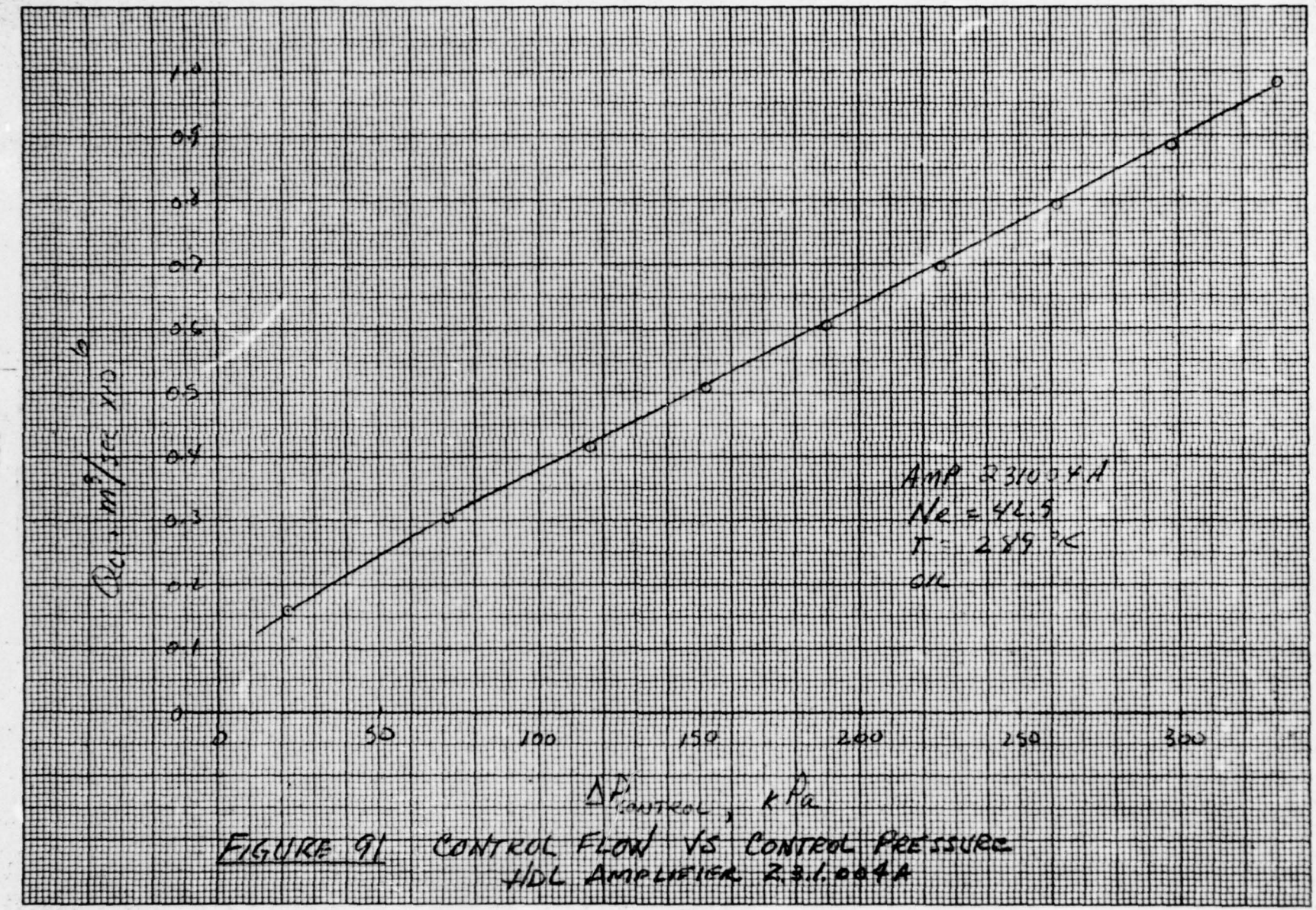



FIGURE 91 CONTROL FLOW VS CONTROL PRESSURE
HDL AMPLIFIER 2.3.1.004A

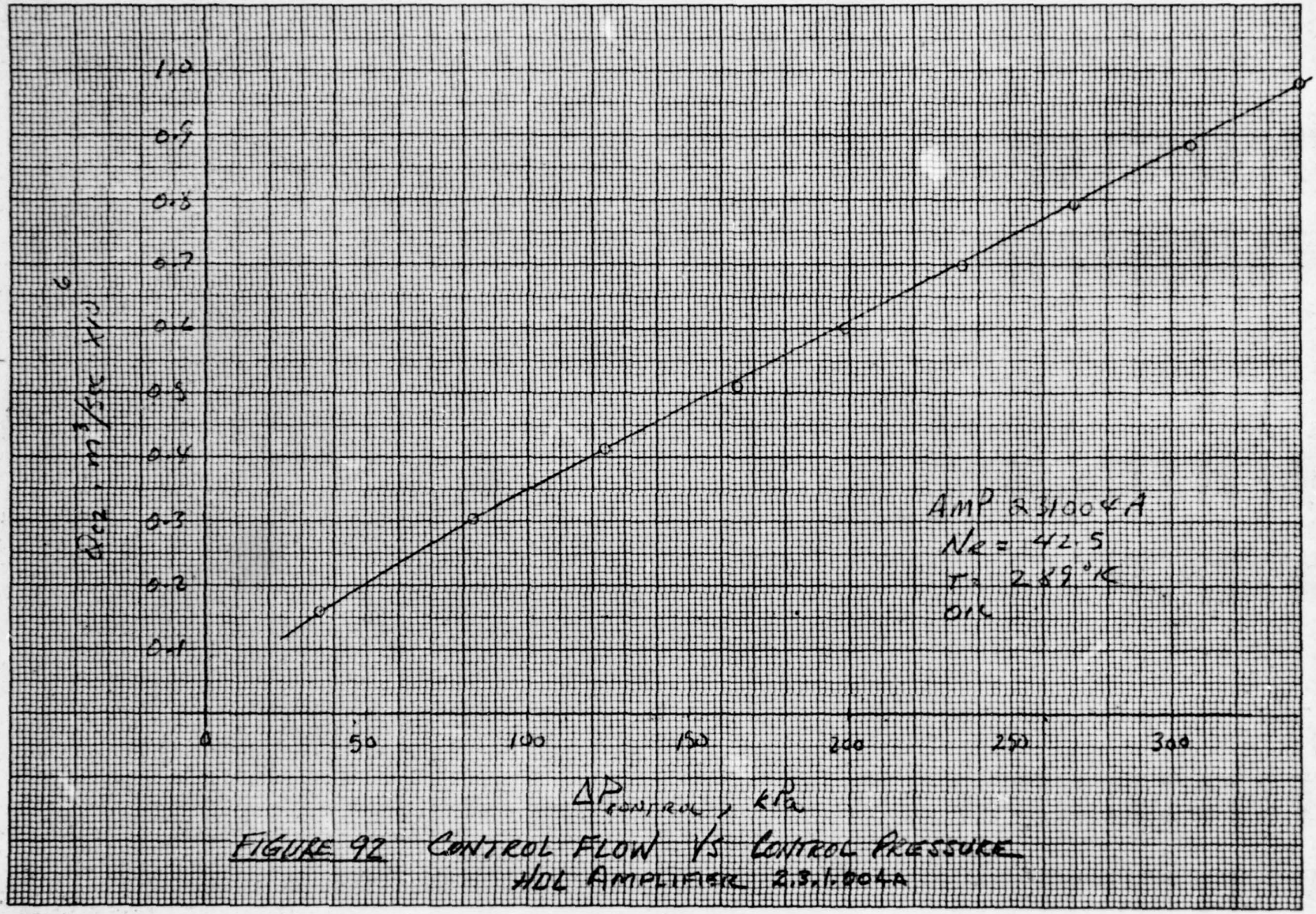



FIGURE 92 CONTROL FLOW VS CONTROL PRESSURE
HDL AMPLIFIER 2.3.1.004A

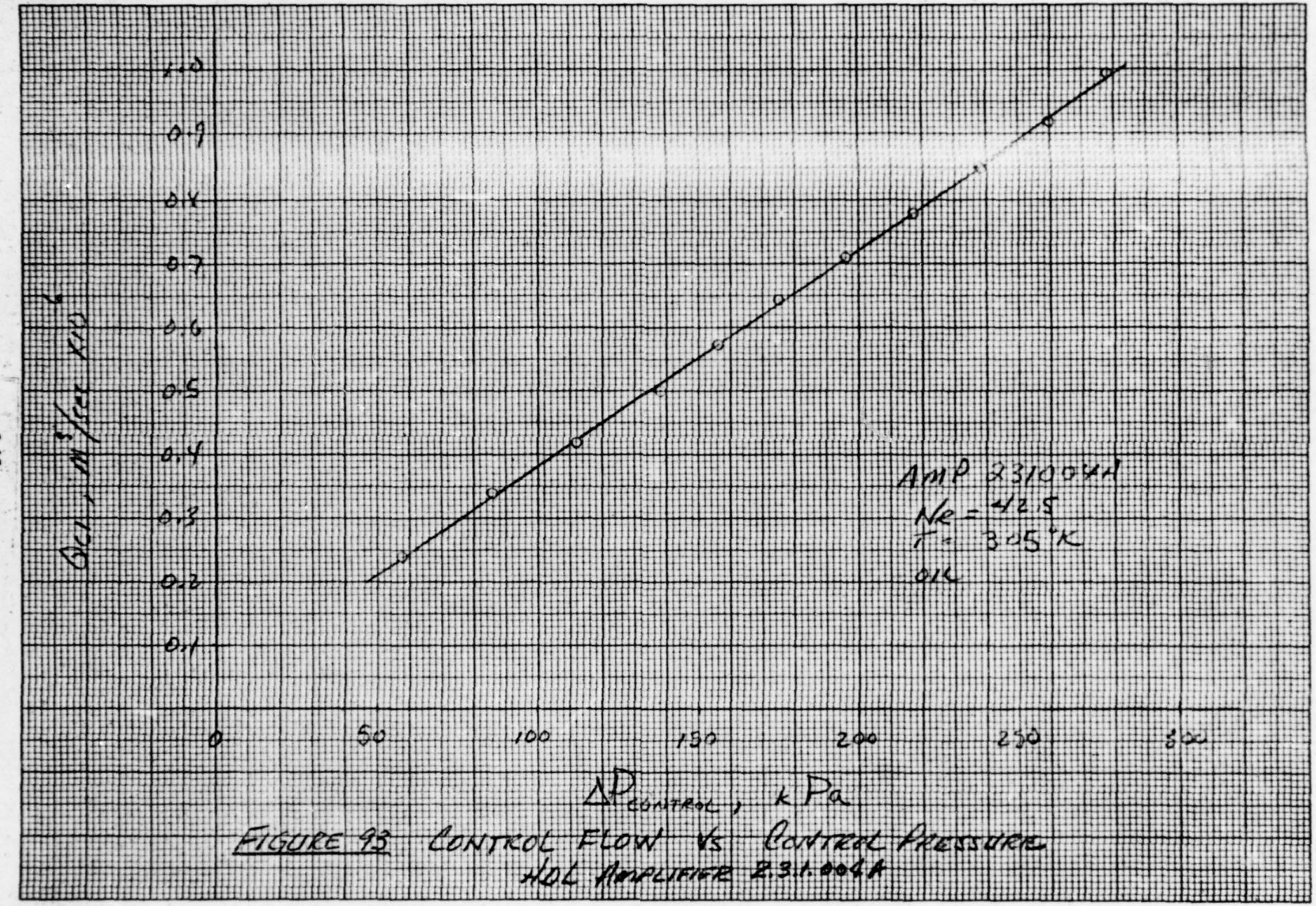



FIGURE 93 CONTROL FLOW VS CONTROL PRESSURE
HDL AMPLIFIER 2.3.1.004A

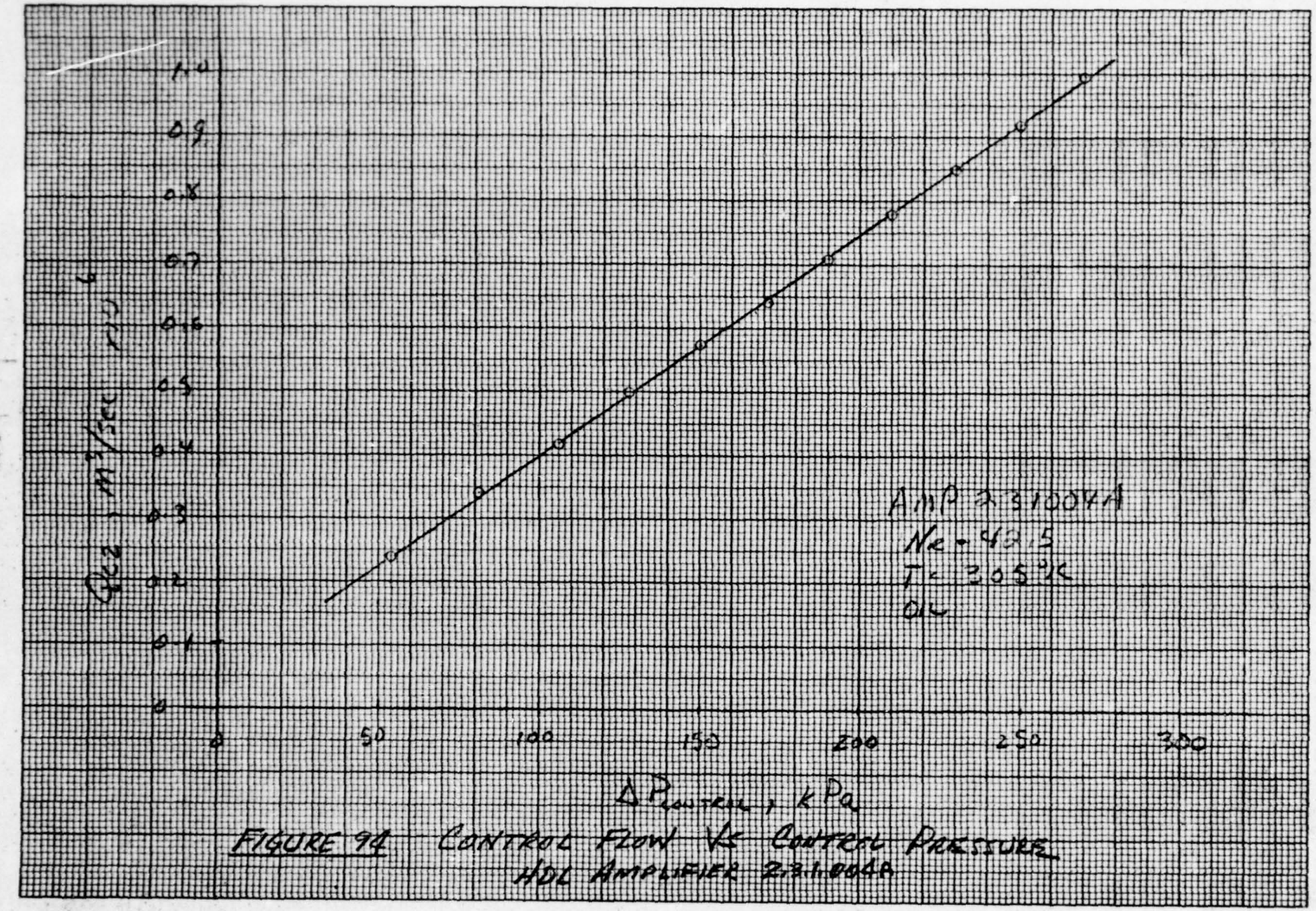



FIGURE 94 CONTROL FLOW VS CONTROL PRESSURE
HDL AMPLIFIER 2.3.1.0040

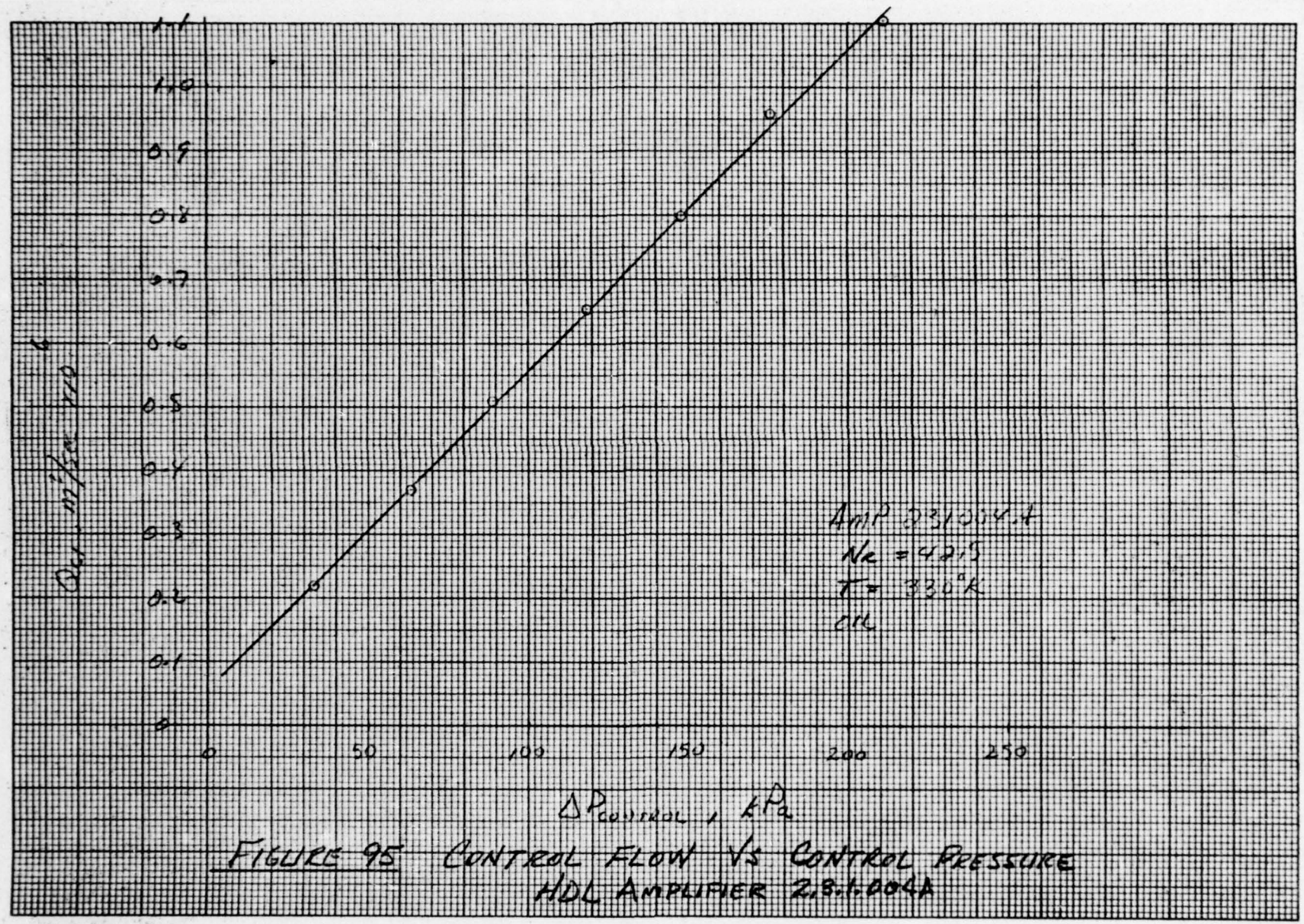



FIGURE 95 CONTROL FLOW VS CONTROL PRESSURE
HDL AMPLIFIER 2.8.1.004A

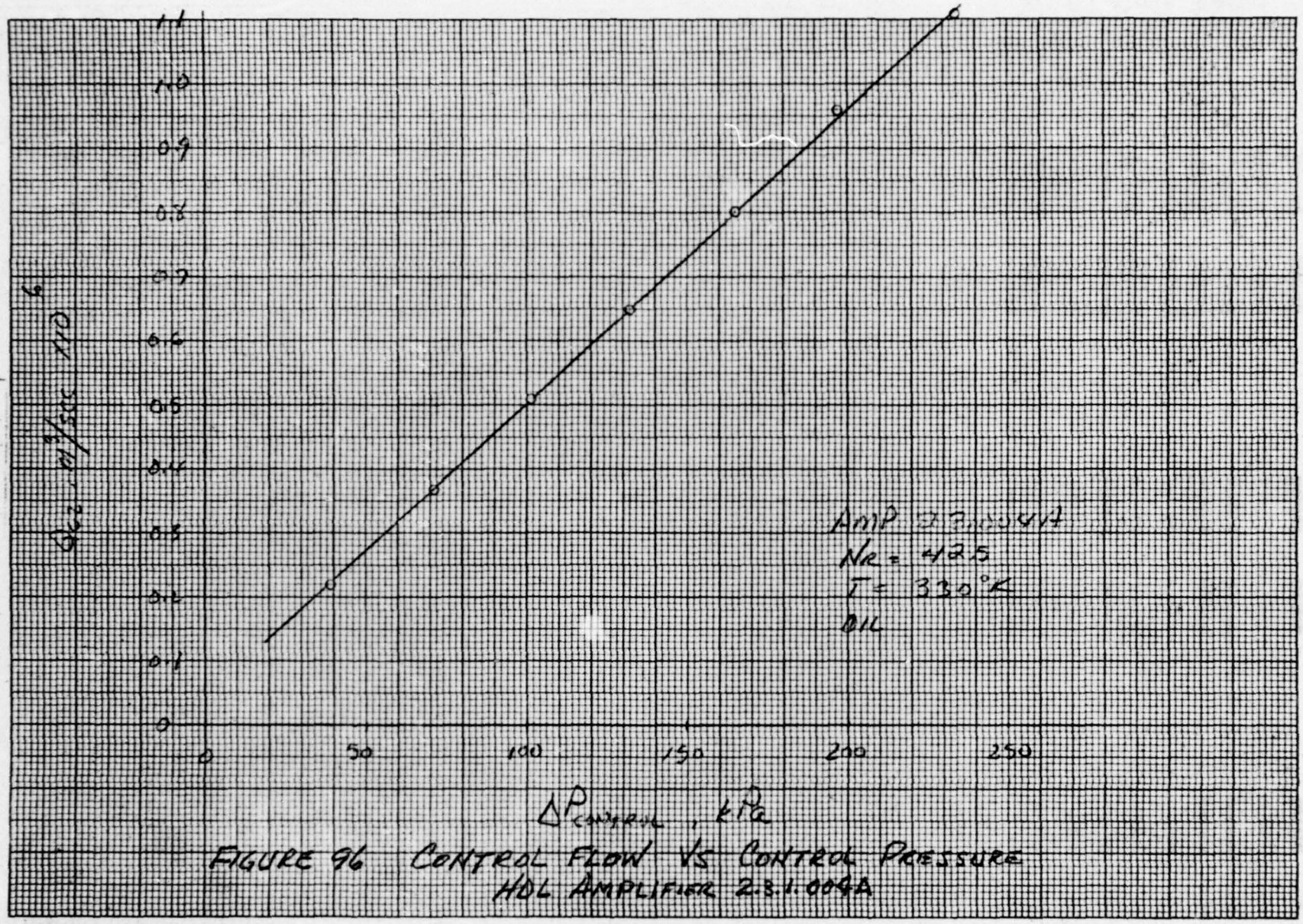



FIGURE 96 CONTROL FLOW VS CONTROL PRESSURE
HDL AMPLIFIER 2.8.1.004A

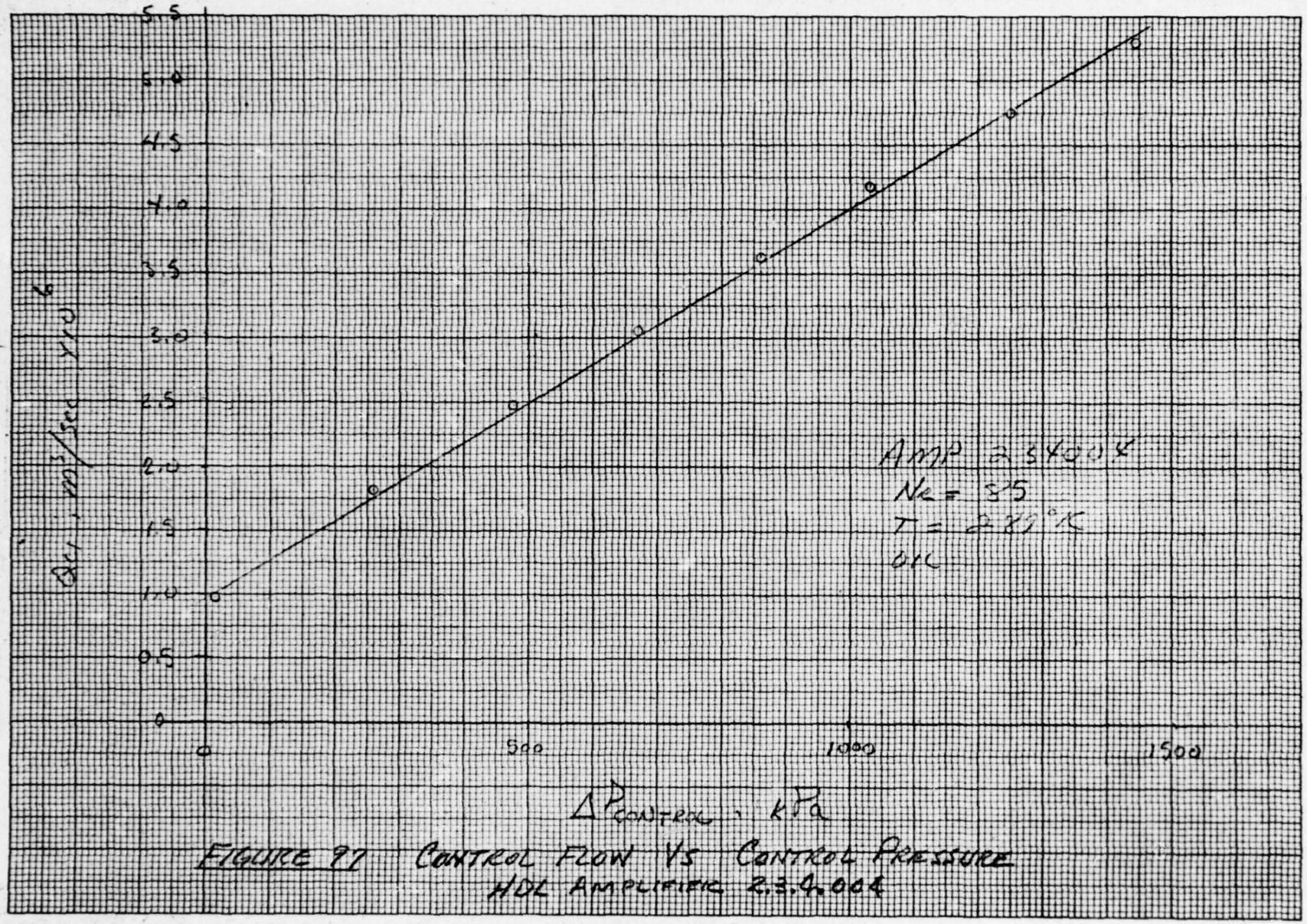



FIGURE 97 CONTROL FLOW VS CONTROL PRESSURE
HDL AMPLIFIC. 2.3.4.004

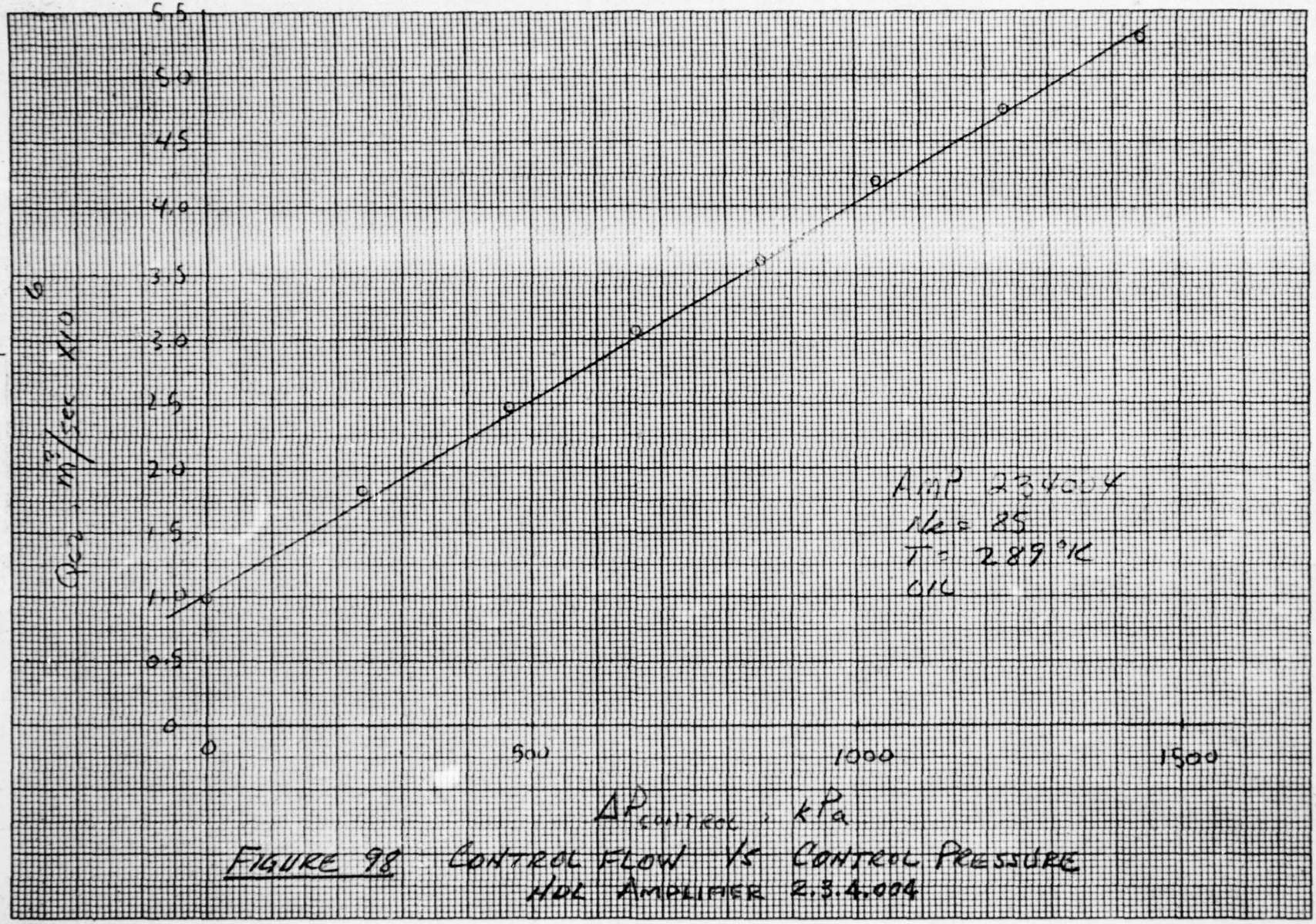



FIGURE 98 CONTROL FLOW VS CONTROL PRESSURE
HDL AMPLIFIER 2.3.4.004

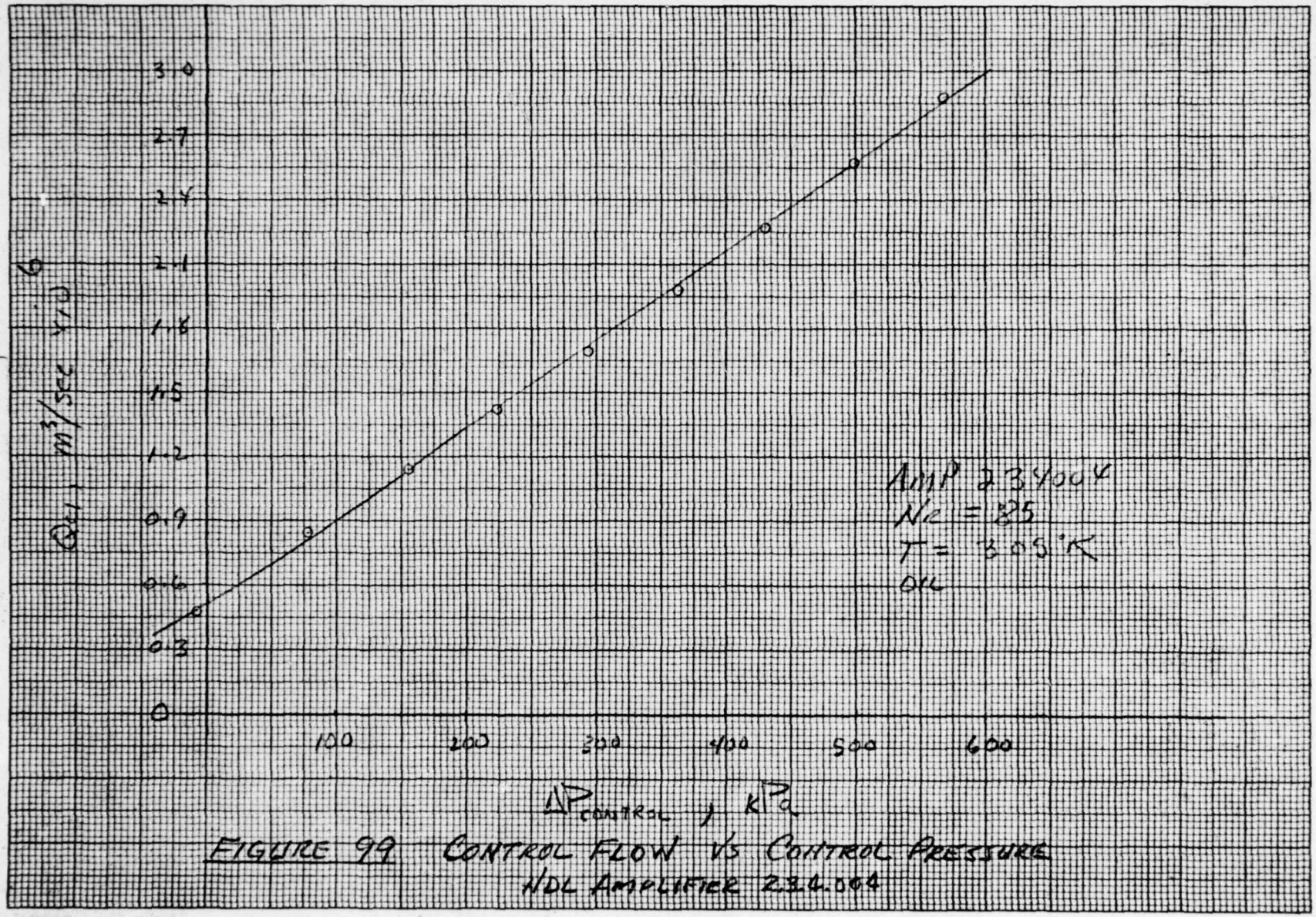



FIGURE 99 CONTROL FLOW VS CONTROL PRESSURE
NDL AMPLIFIER 234.004

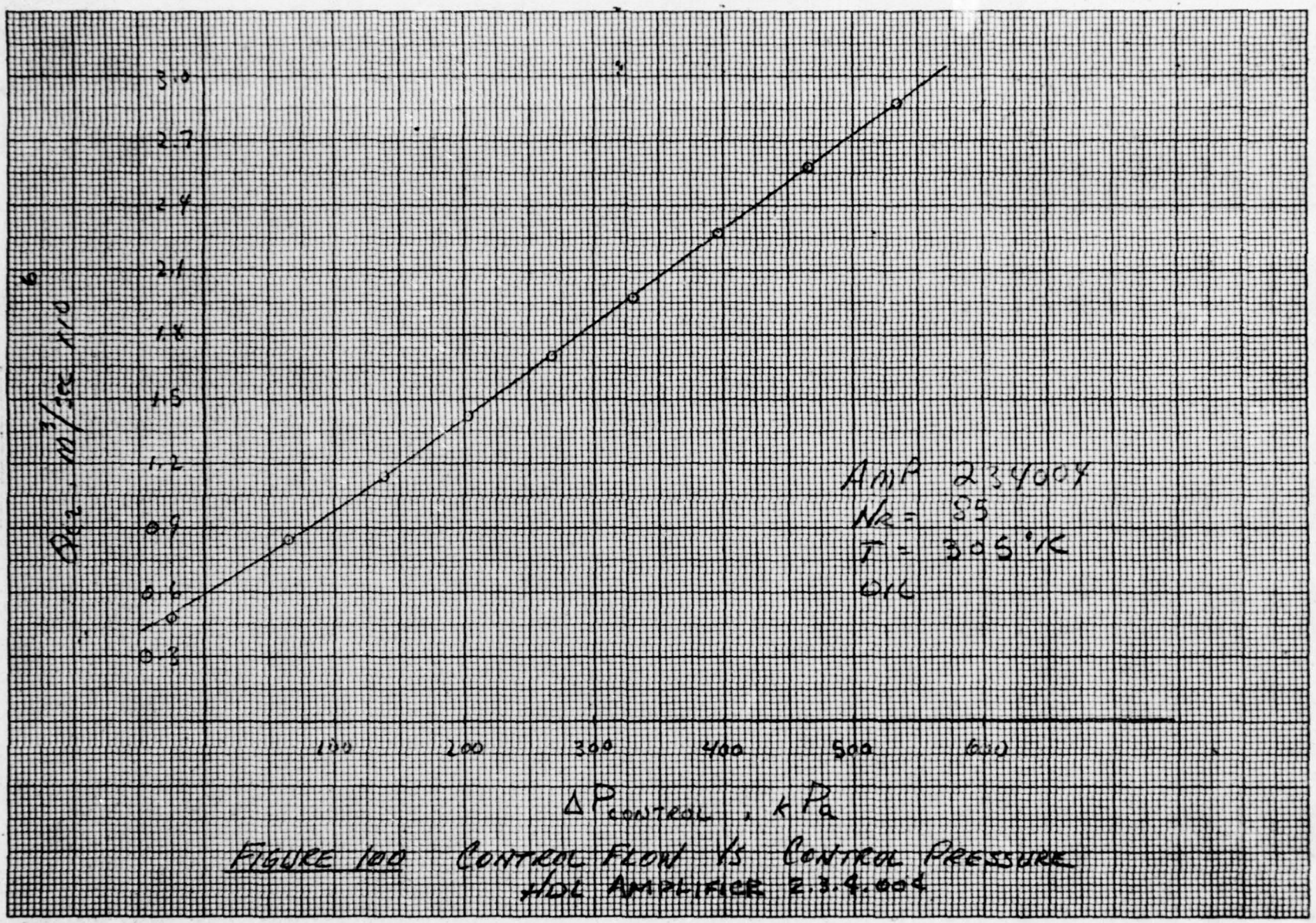



FIGURE 100 CONTROL FLOW VS CONTROL PRESSURE
HDL AMPLIFIER 2.3.4.004

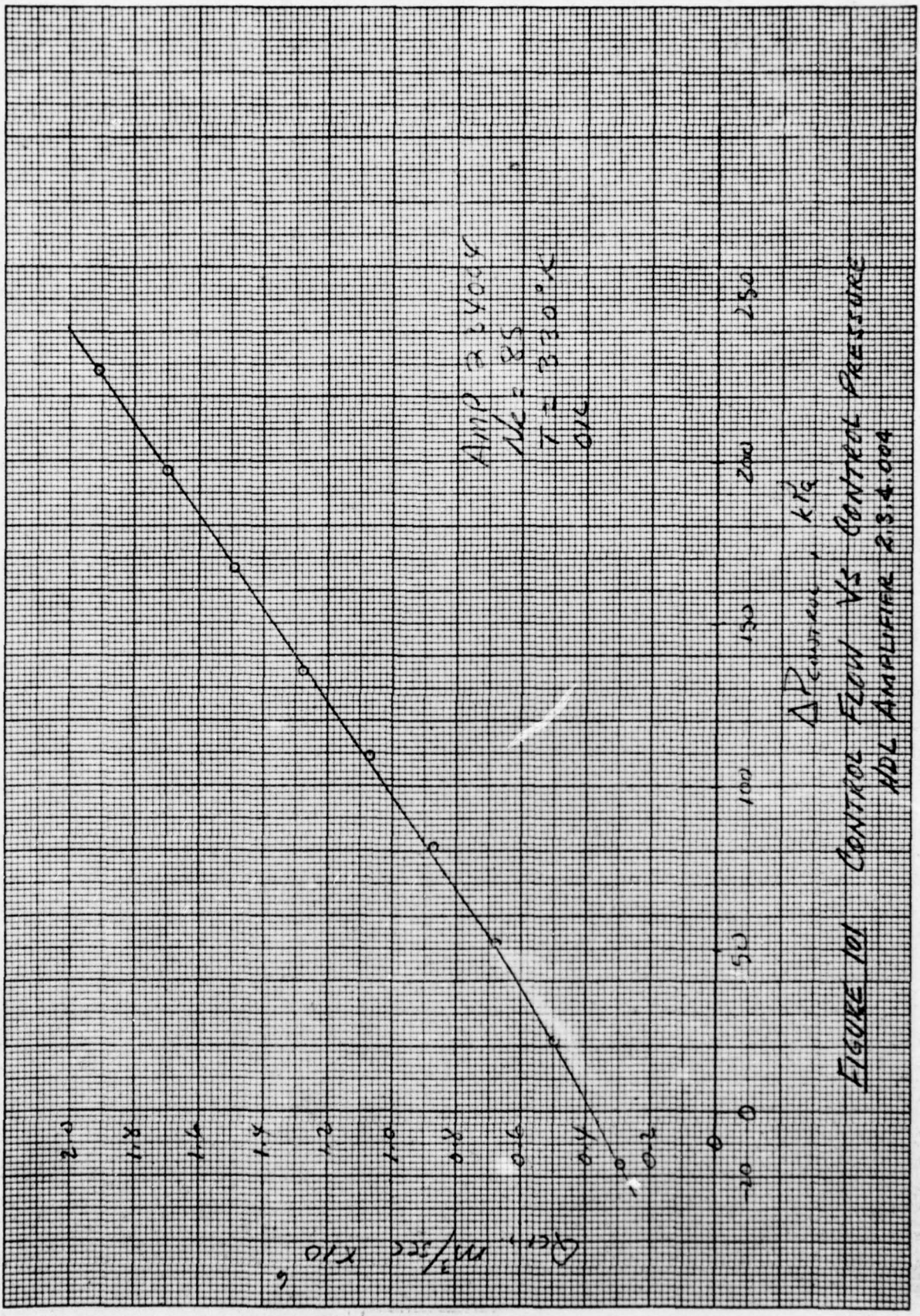



FIGURE 101 CONTROL FLOW VS CONTROL PRESSURE
HDL AMPLIFIER 2.3.4.004

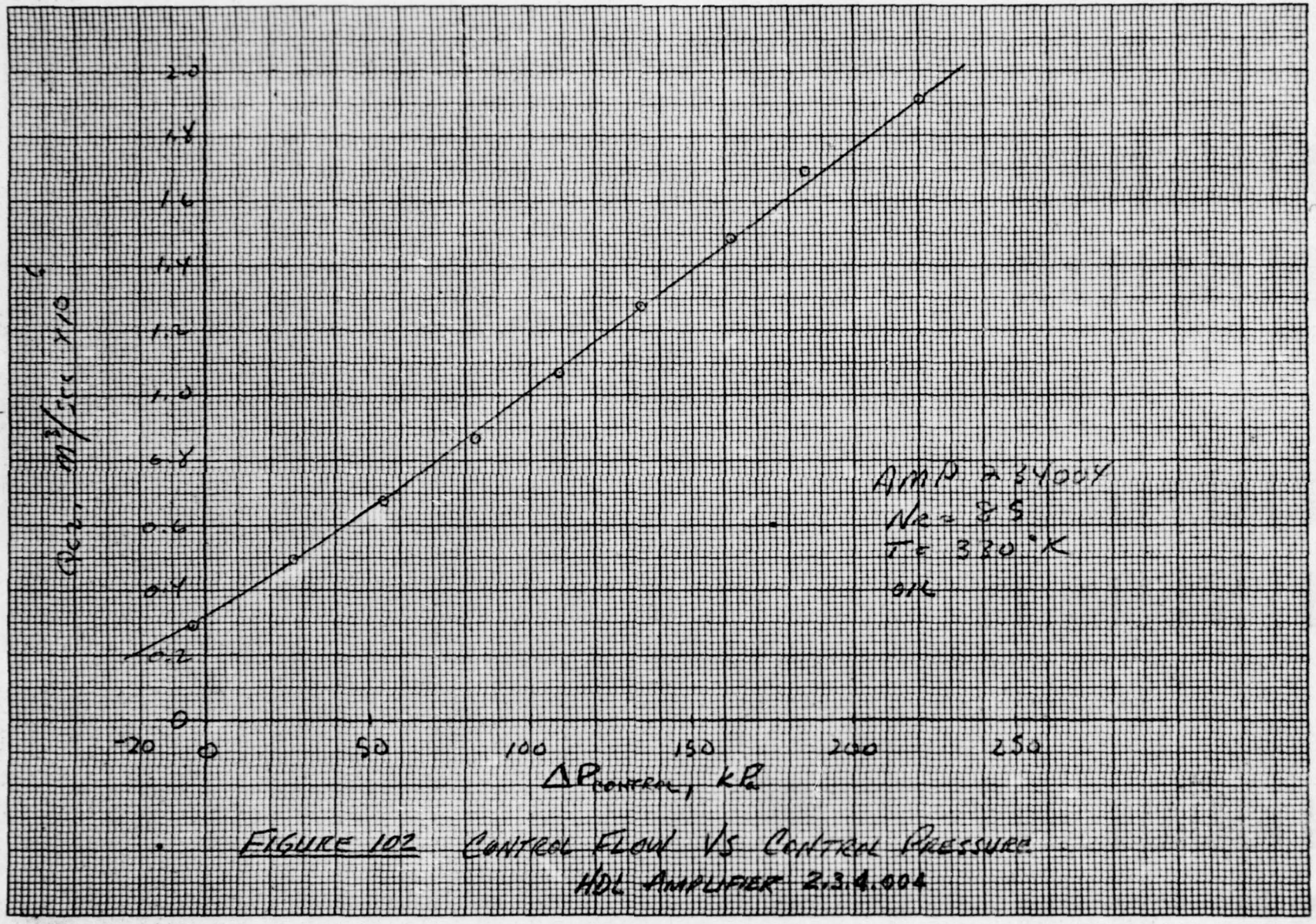



FIGURE 102 CONTROL FLOW VS CONTROL PRESSURE
HDL AMPLIFIER 2.3.4.004

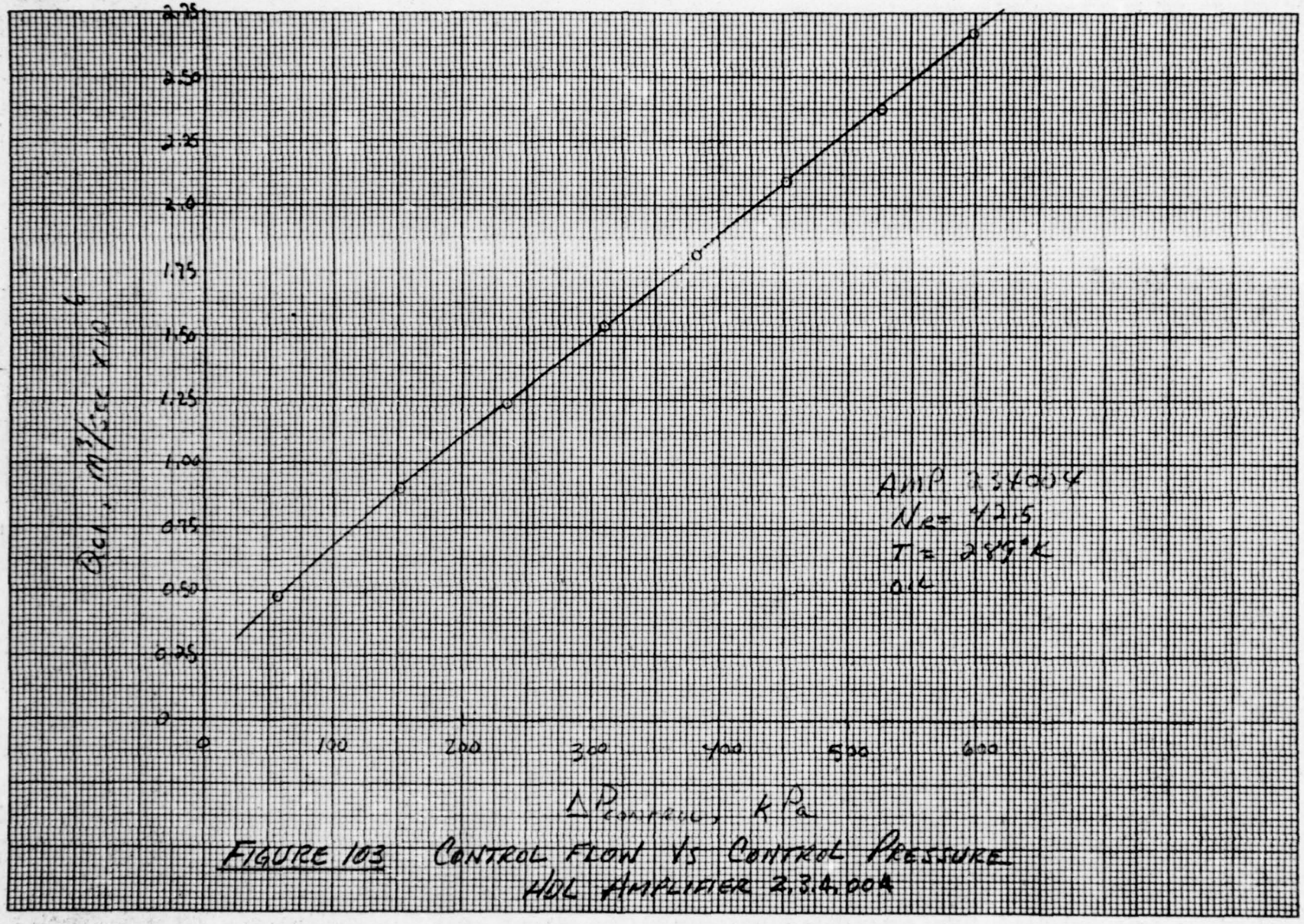



FIGURE 103 CONTROL FLOW VS CONTROL PRESSURE
HDL AMPLIFIER 2.3.4.004

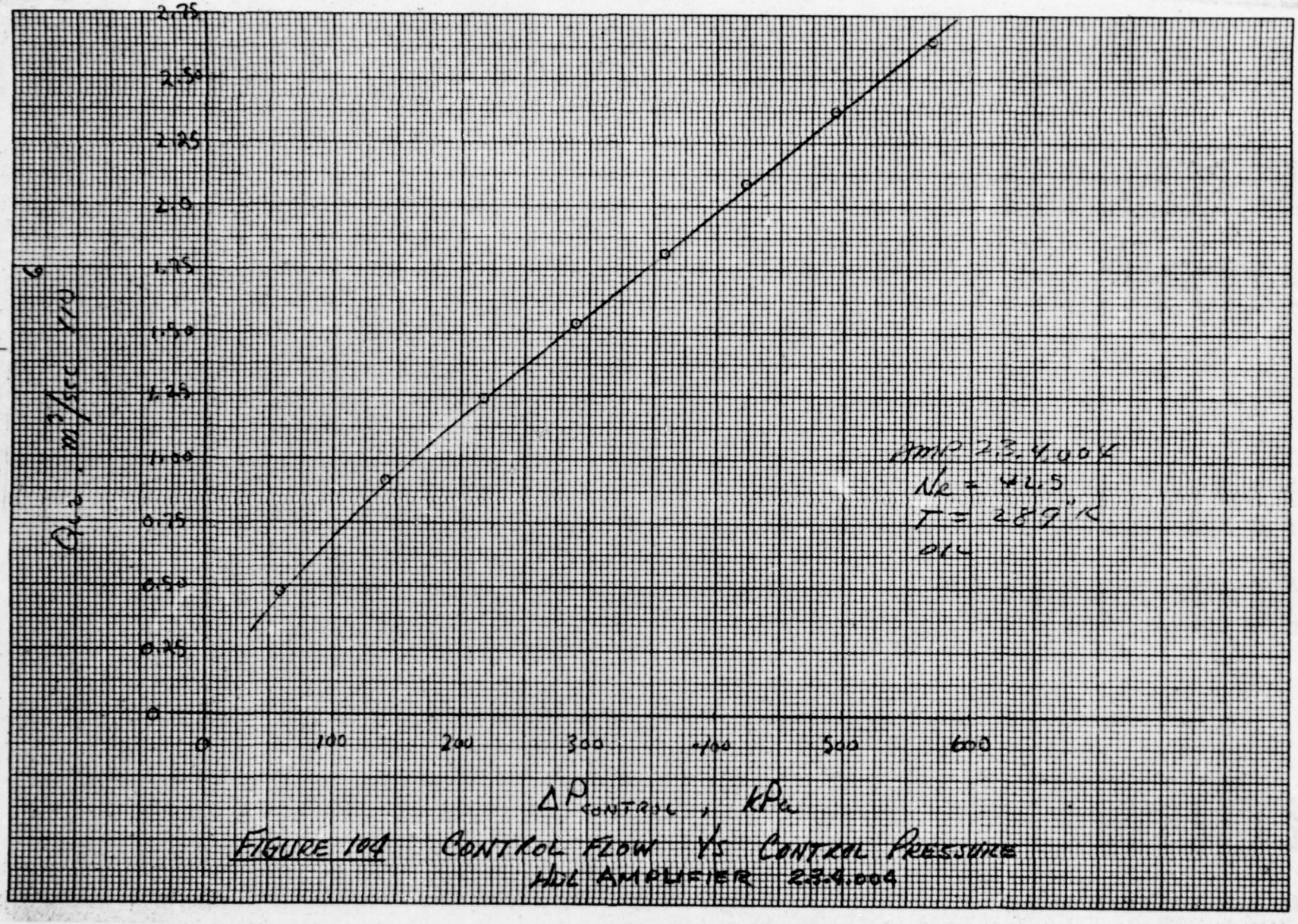



FIGURE 104 CONTROL FLOW VS CONTROL PRESSURE
HOL AMPLIFIER 23.4.004




FIGURE 105 CONTROL FLOW VS CONTROL PRESSURE
HDL AMPLIFIER 2.34.004

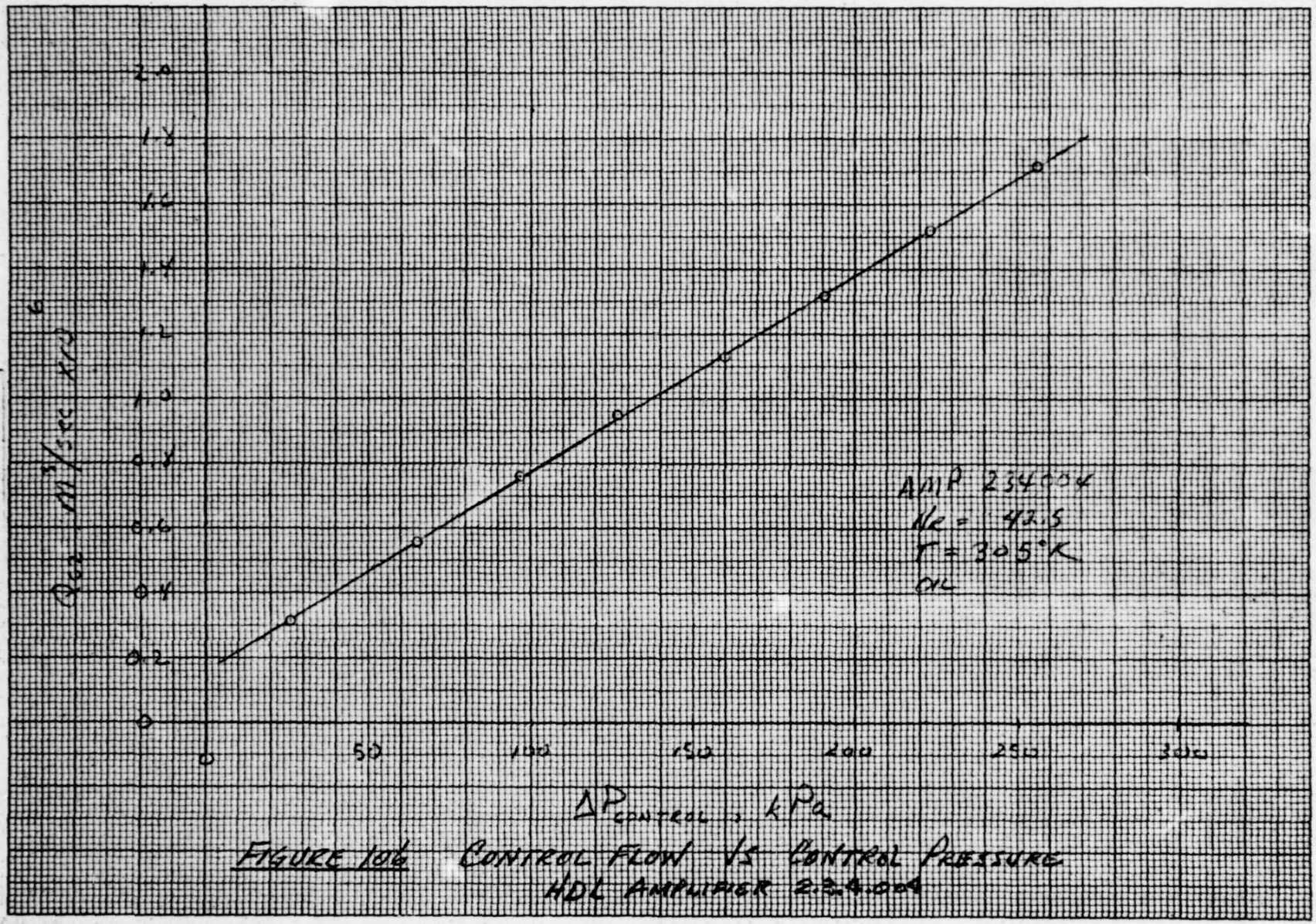



FIGURE 106 CONTROL FLOW VS CONTROL PRESSURE
HDL AMPLIFIER 2.3.4.004

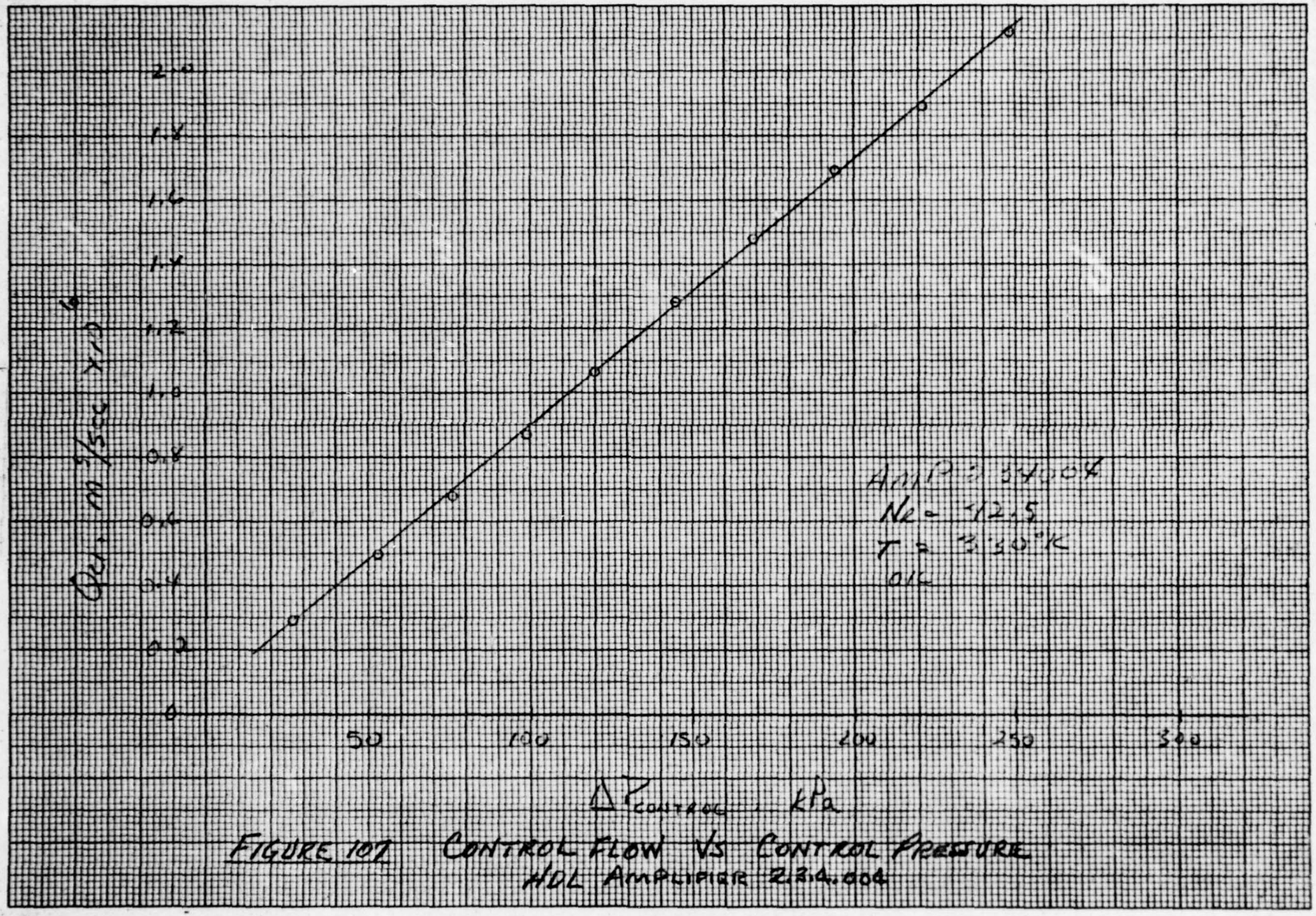



FIGURE 107 CONTROL FLOW VS CONTROL PRESSURE
HDL AMPLIFIER 2.3.4.004

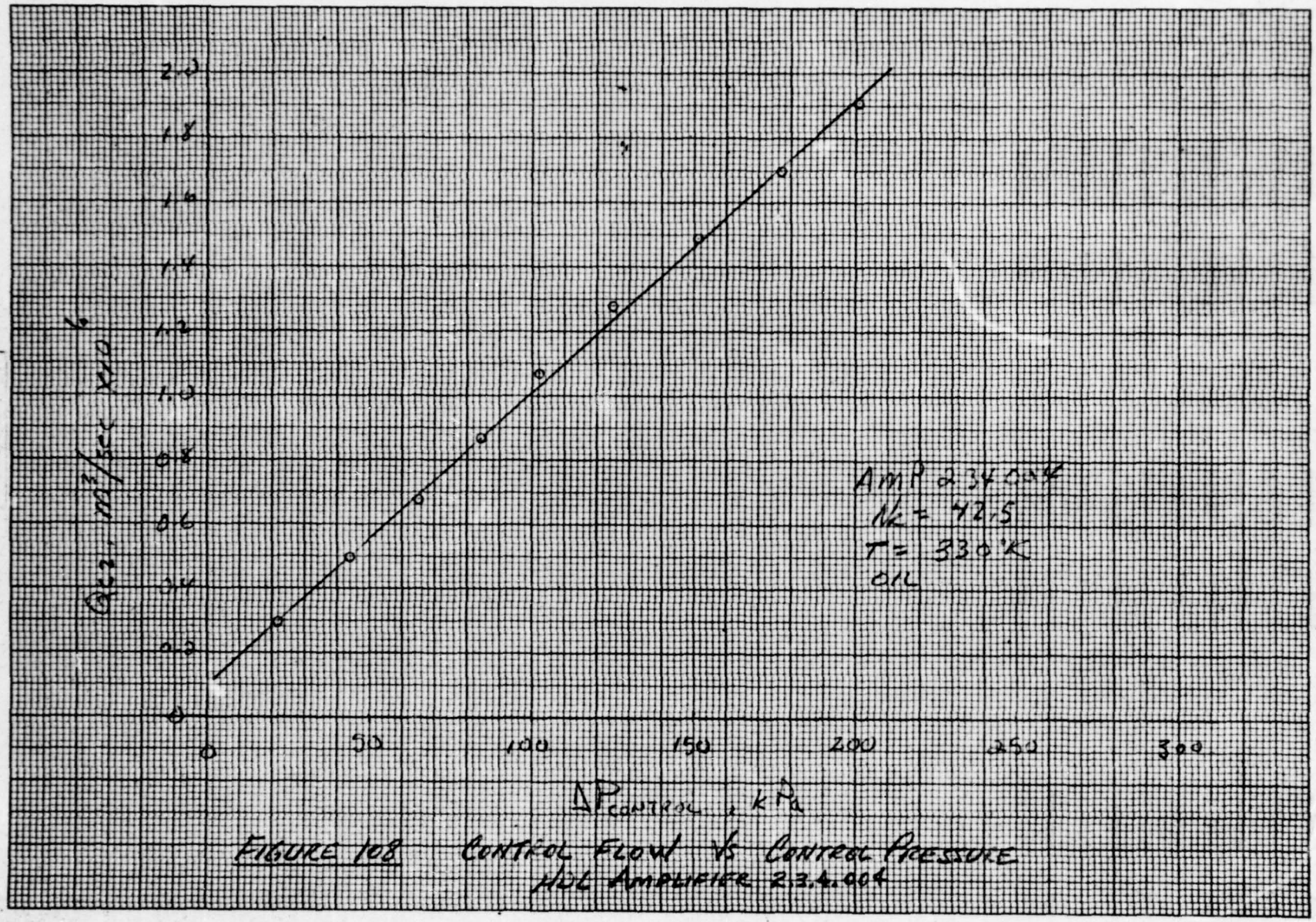



FIGURE 108 CONTROL FLOW VS CONTROL PRESSURE
HDL AMPLIFIER 2.3.4.004

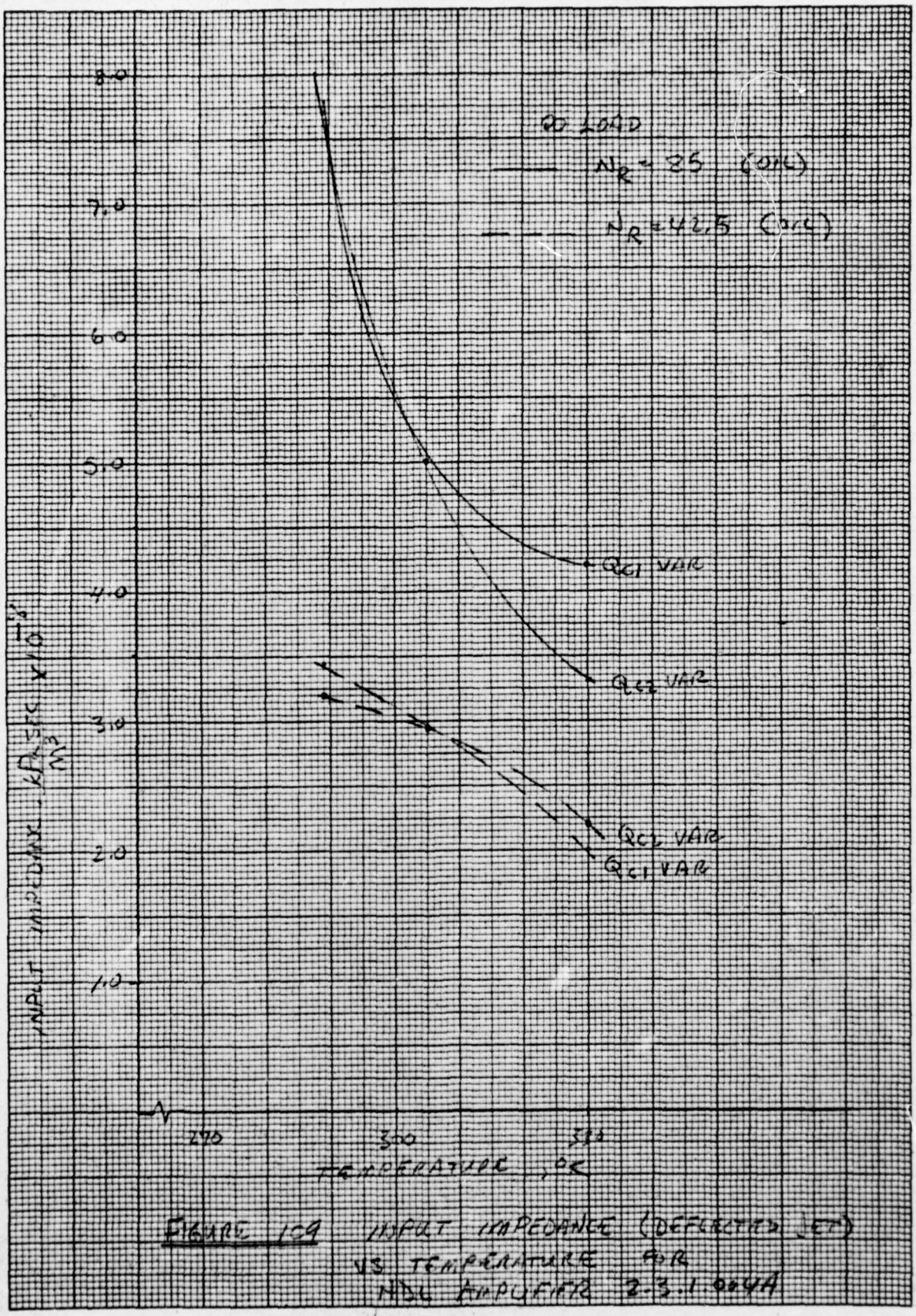



FIGURE 109 INPUT IMPEDANCE (DEFLECTED JET) VS TEMPERATURE FOR HDL AMPLIFIER 2-3-1 004A

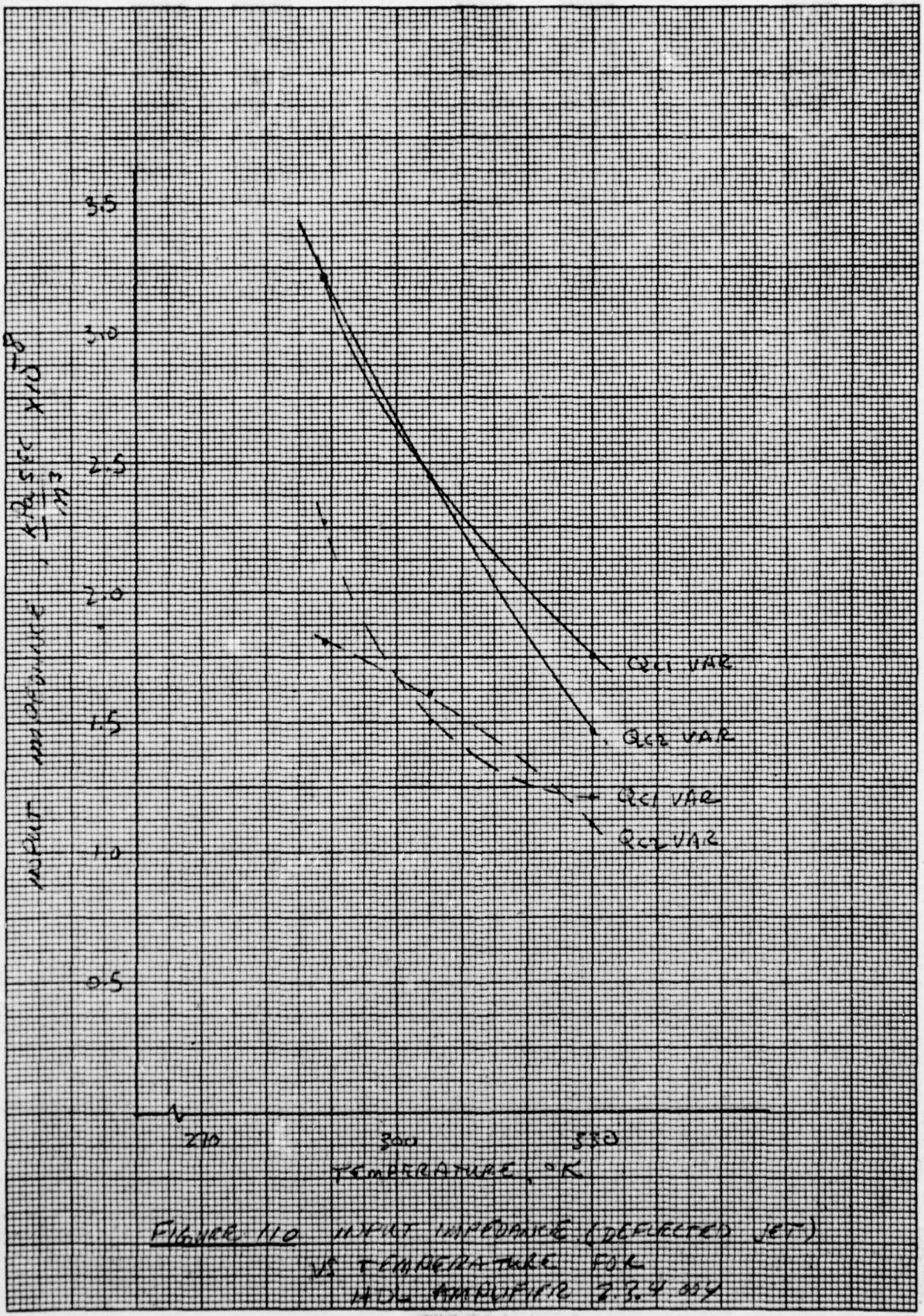



FIGURE 110 INPUT IMPEDANCE (DEFLECTED JET) VS TEMPERATURE FOR HDL AMPLIFIER 2.3.4 05Y

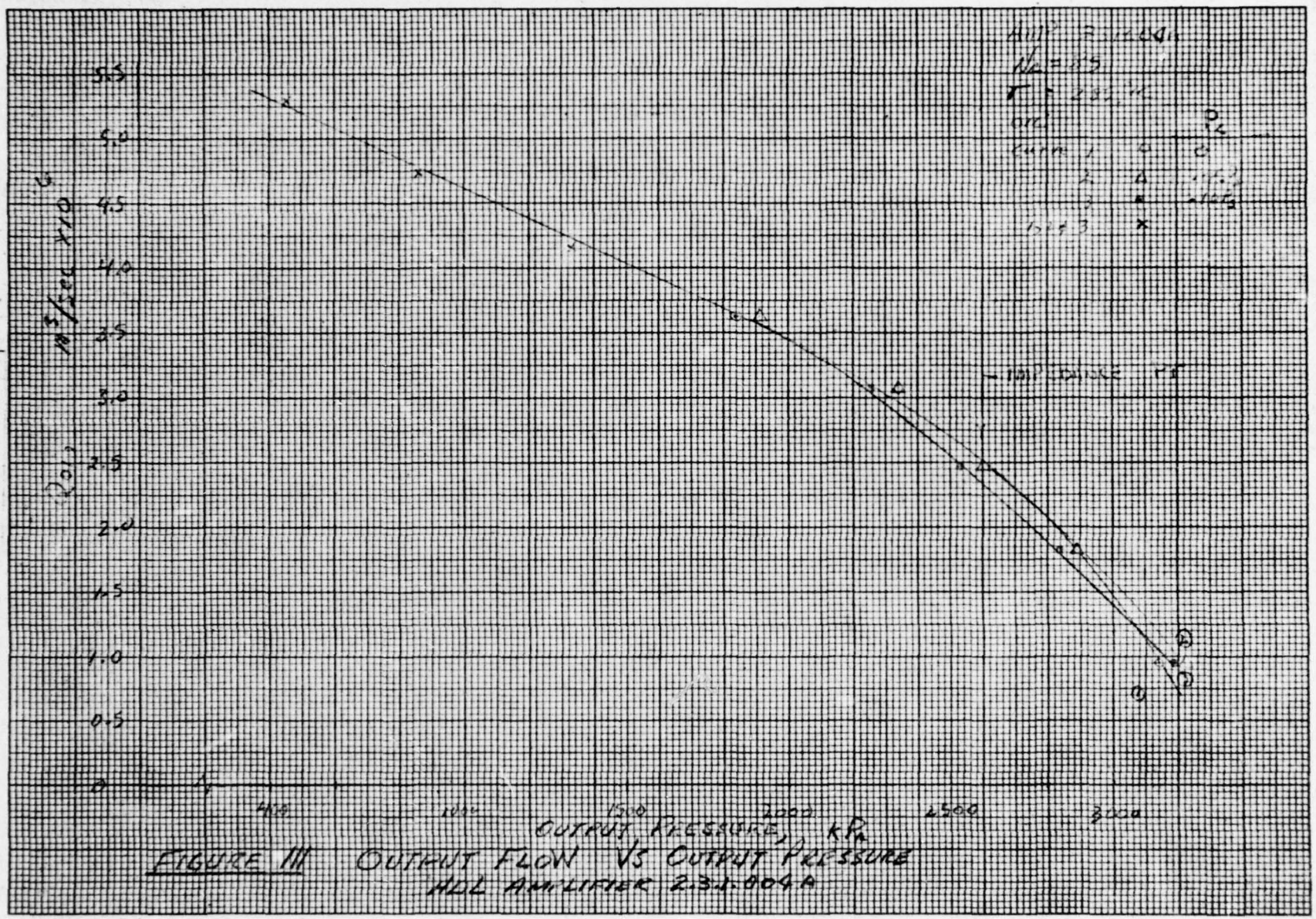



FIGURE III OUTPUT FLOW VS OUTPUT PRESSURE
HDL AMPLIFIER 2.34.004A

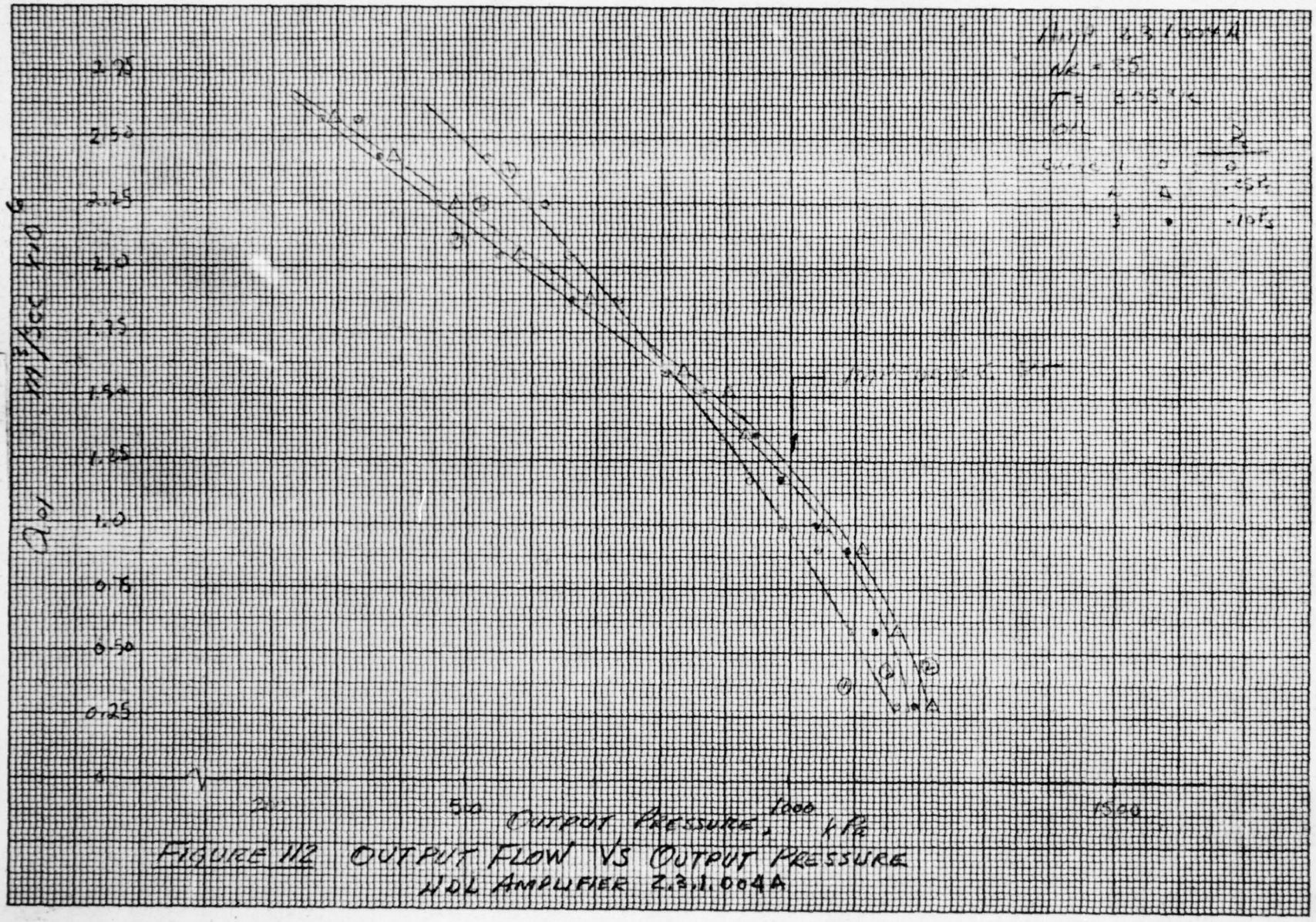



FIGURE 112 OUTPUT FLOW VS OUTPUT PRESSURE
W.D.L. AMPLIFIER 2.3.1.004A

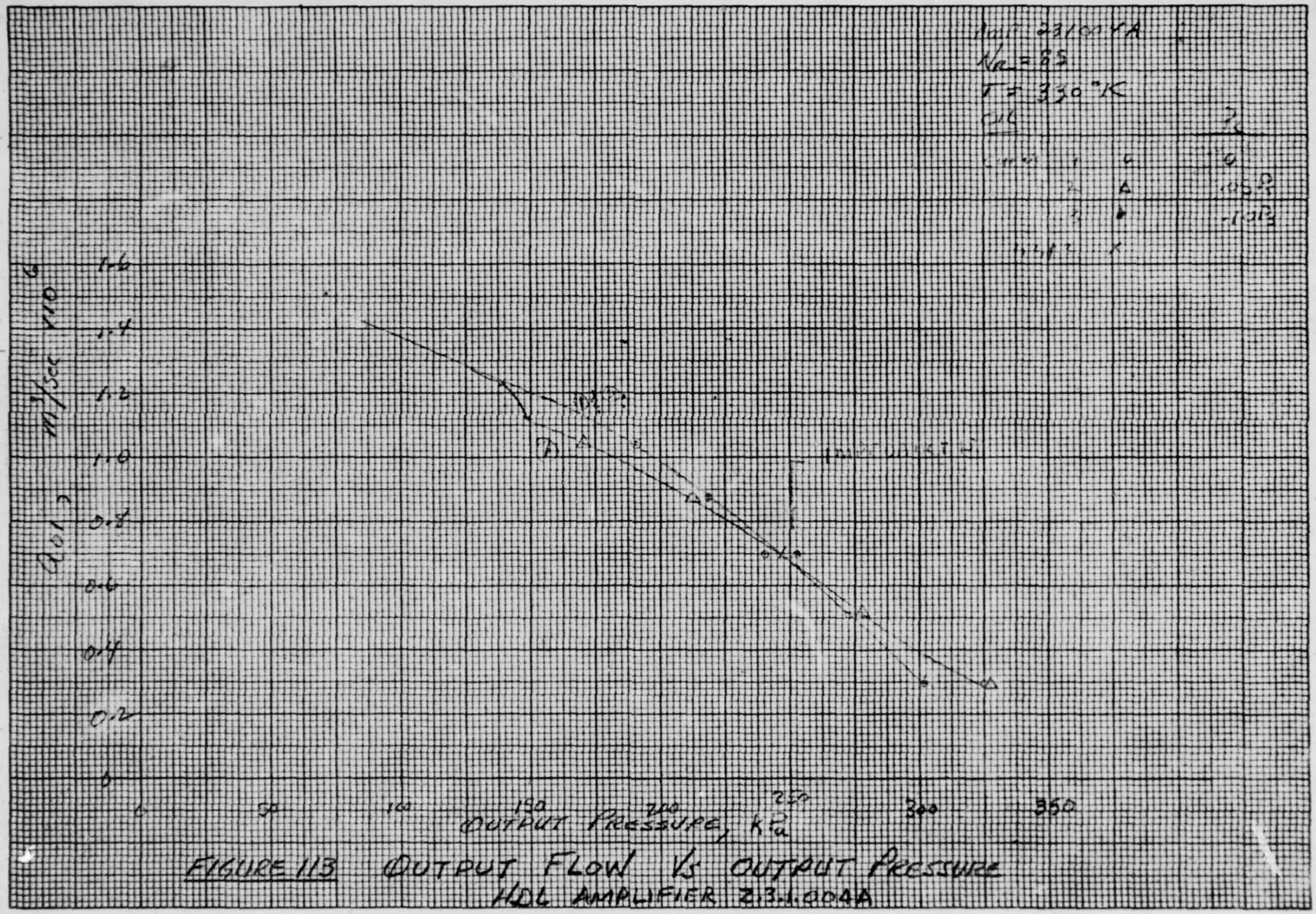



FIGURE 113 OUTPUT FLOW VS OUTPUT PRESSURE
HDL AMPLIFIER 2.3.1.004A

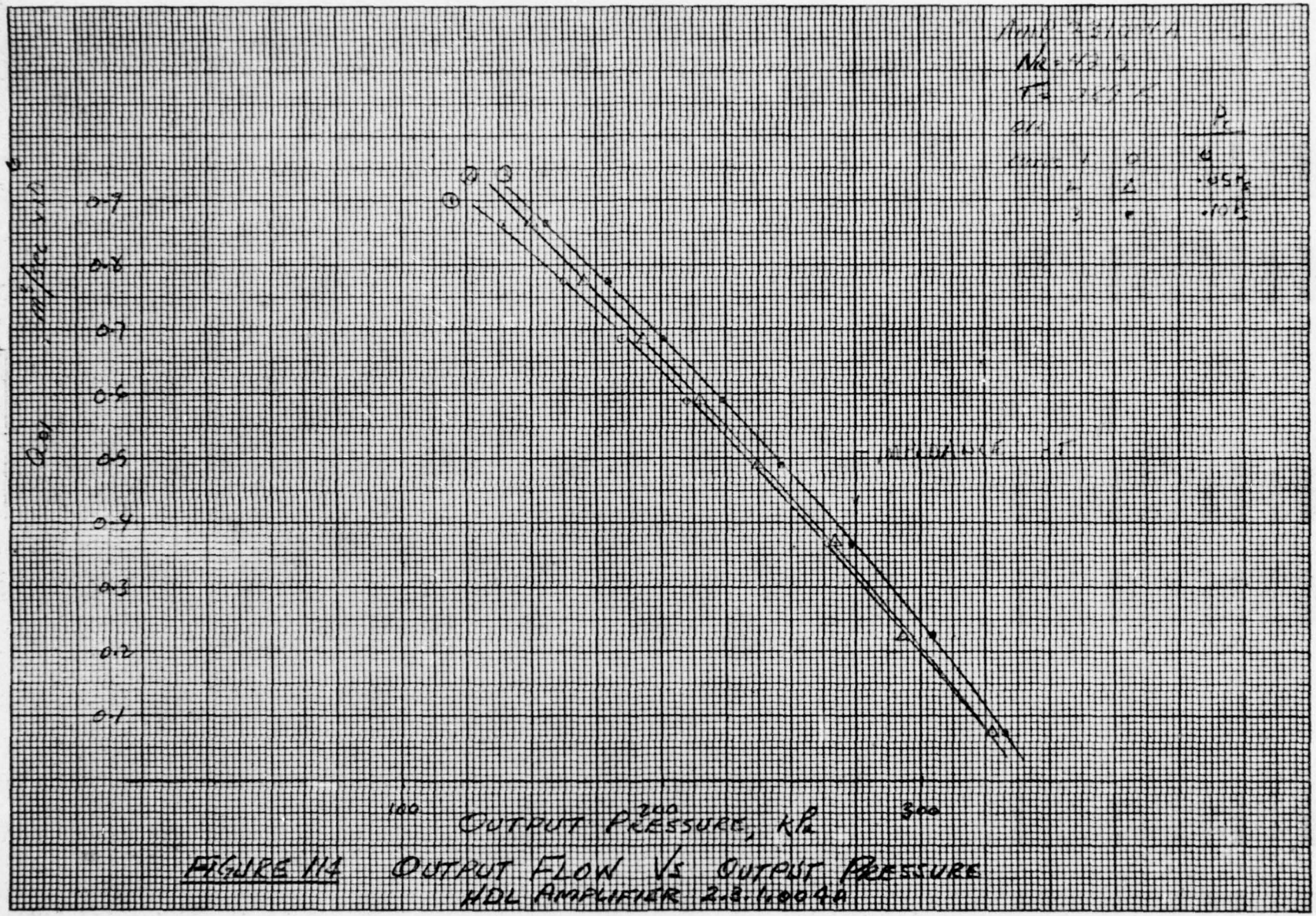



FIGURE 114 OUTPUT FLOW VS OUTPUT PRESSURE
HDL AMPLIFIER 2.8.1.00.4.0

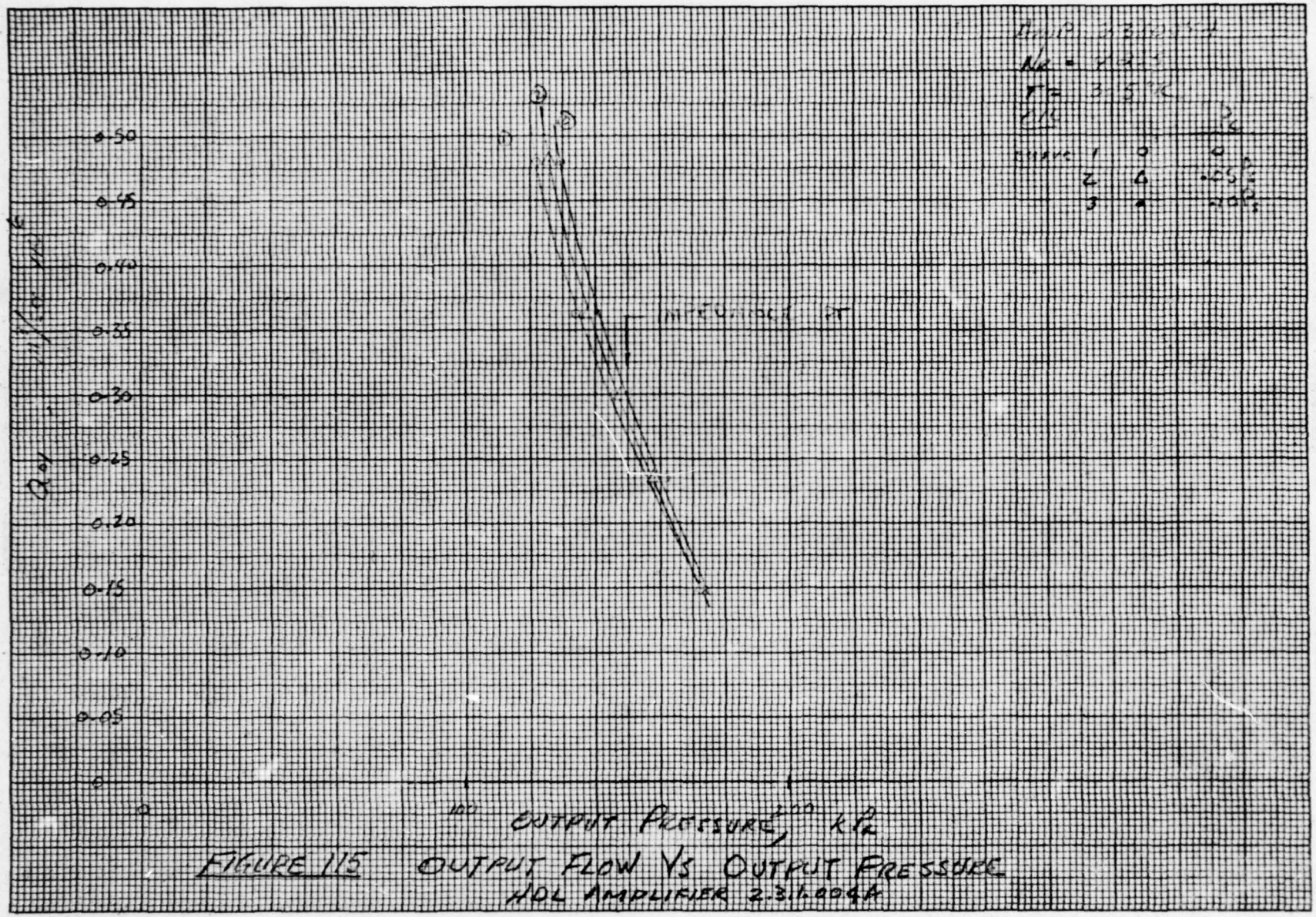



FIGURE 115 OUTPUT FLOW VS OUTPUT PRESSURE
HOL AMPLIFIER 2.3.1.0044

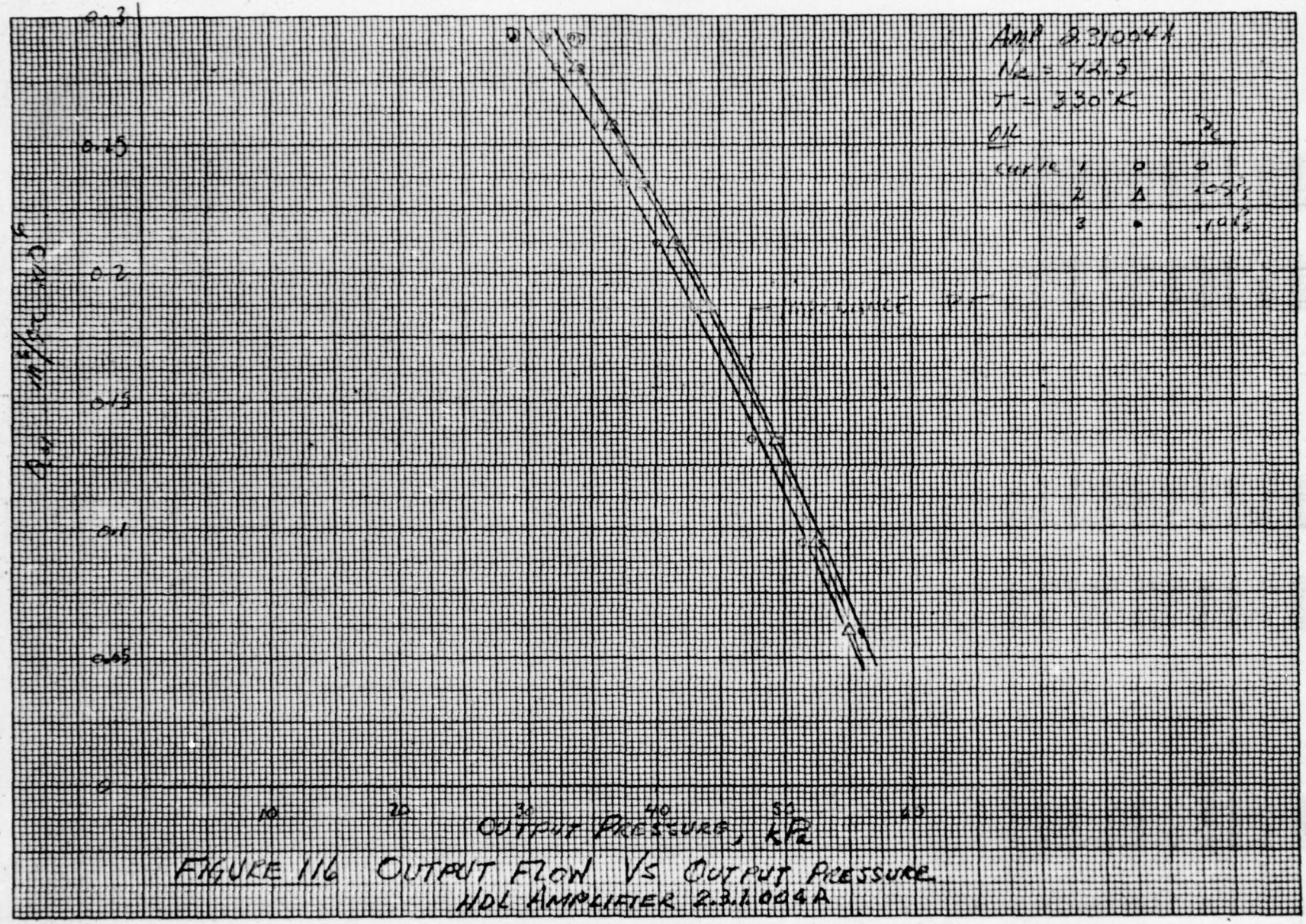



FIGURE 116 OUTPUT FLOW VS OUTPUT PRESSURE.
HDL AMPLIFIER 2.3.1004A

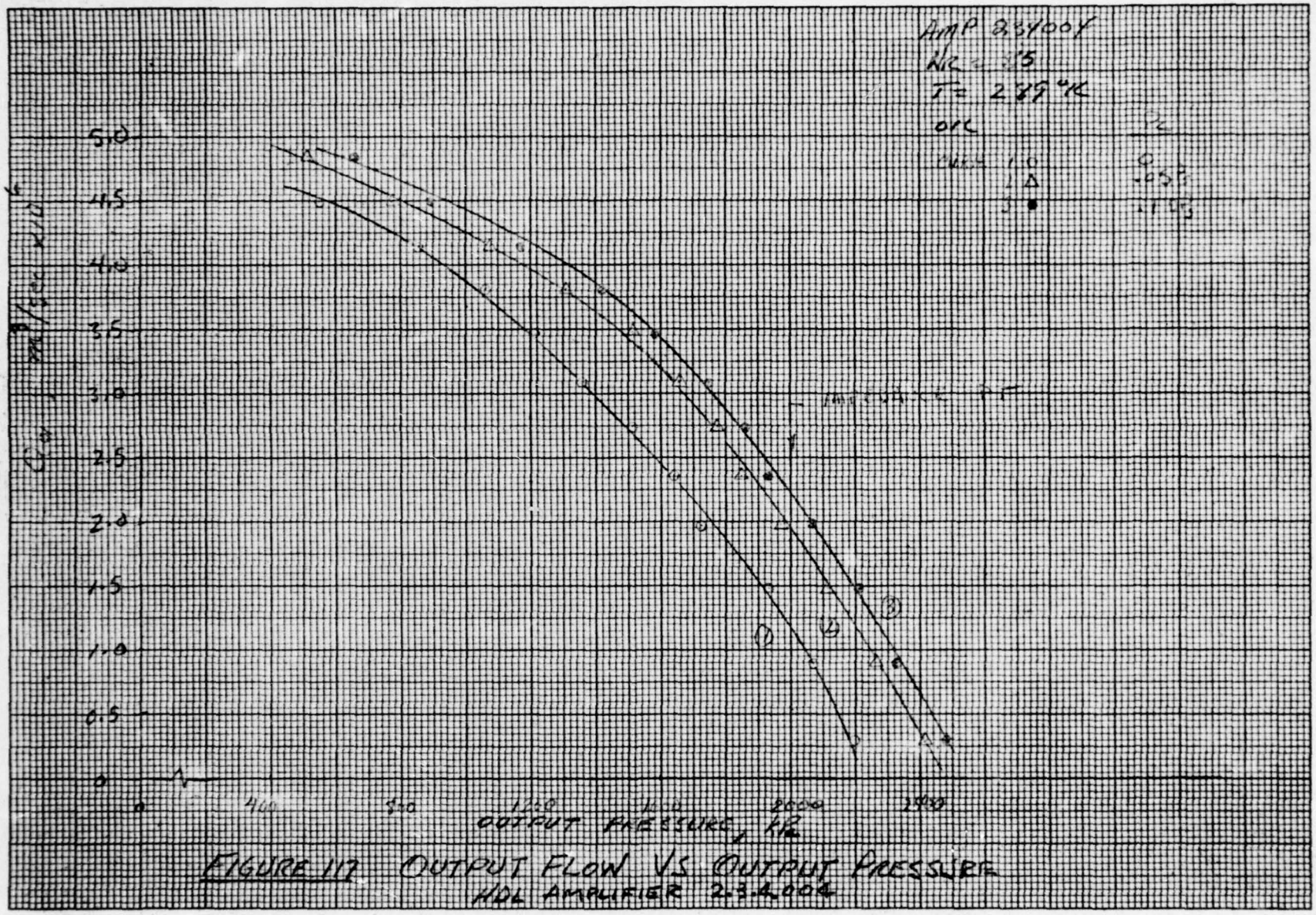



FIGURE 117 OUTPUT FLOW VS OUTPUT PRESSURE
HDL AMPLIFIER 2-3.4.004

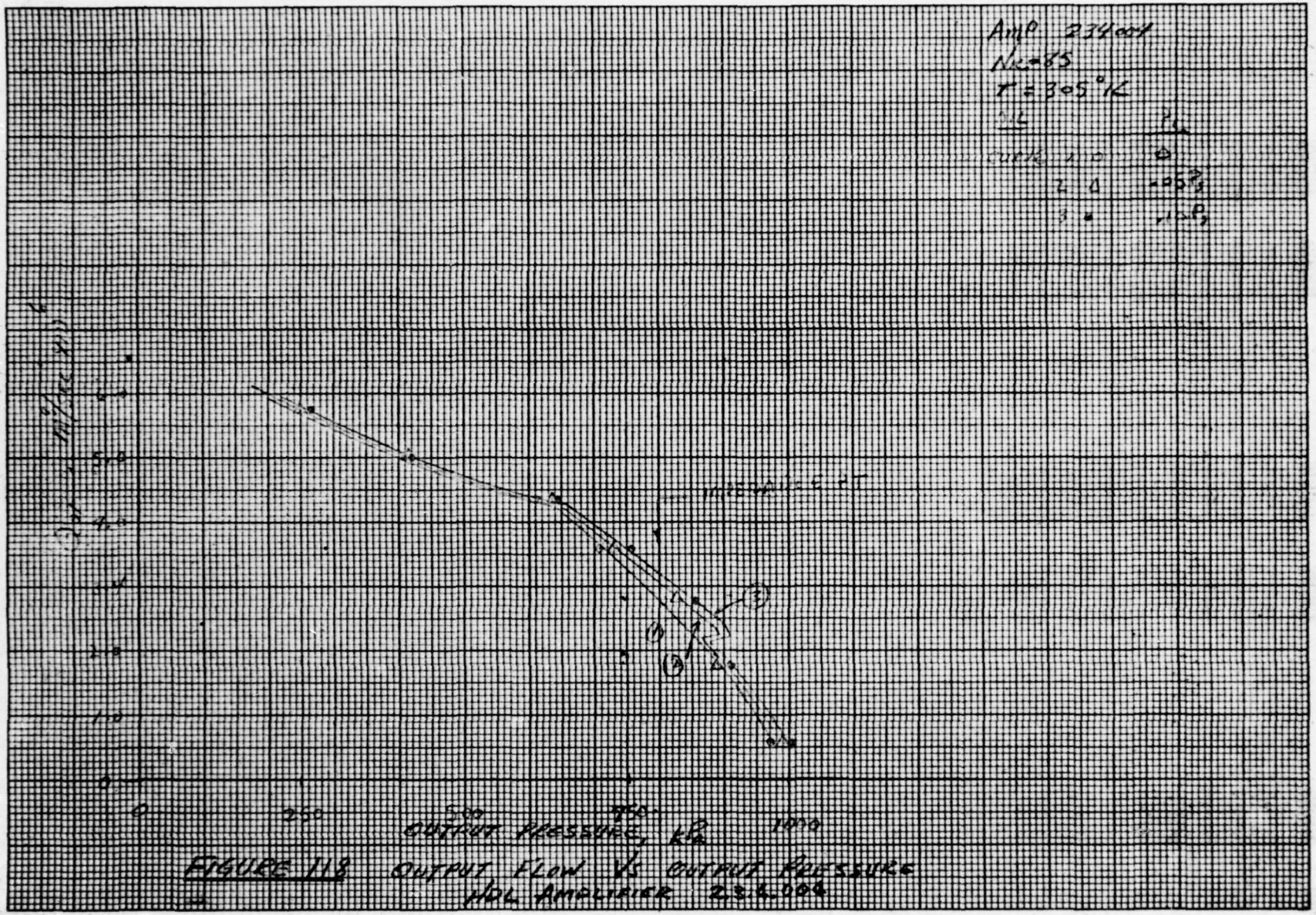



FIGURE 118 OUTPUT FLOW VS OUTPUT PRESSURE
HOL AMPLIFIER 234004

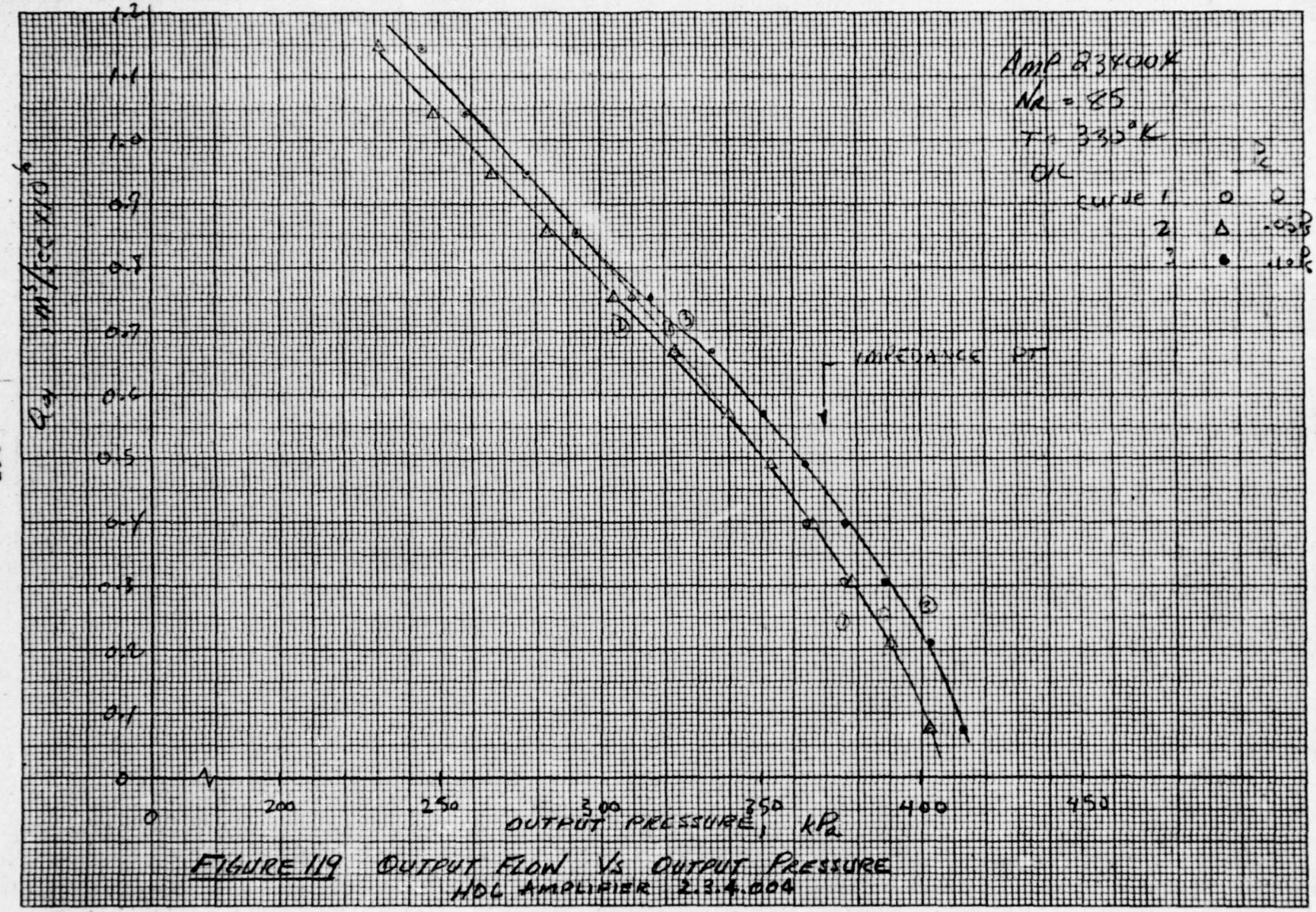



FIGURE 119 OUTPUT FLOW VS OUTPUT PRESSURE
HDG AMPLIFIER 2.3.4.004

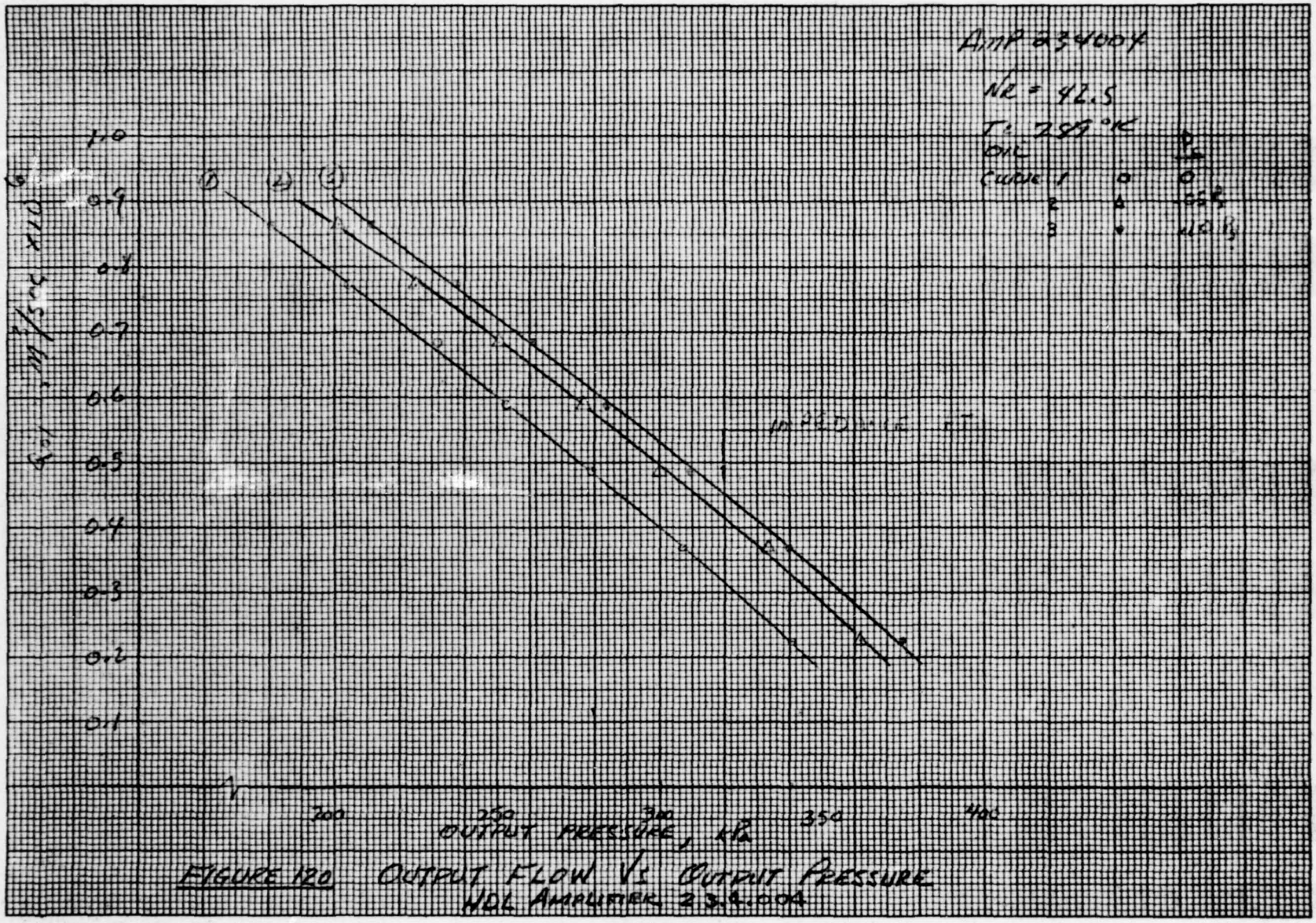



FIGURE 120 OUTPUT FLOW Vs OUTPUT PRESSURE
NOL AMPLIFIER 23.8.00A

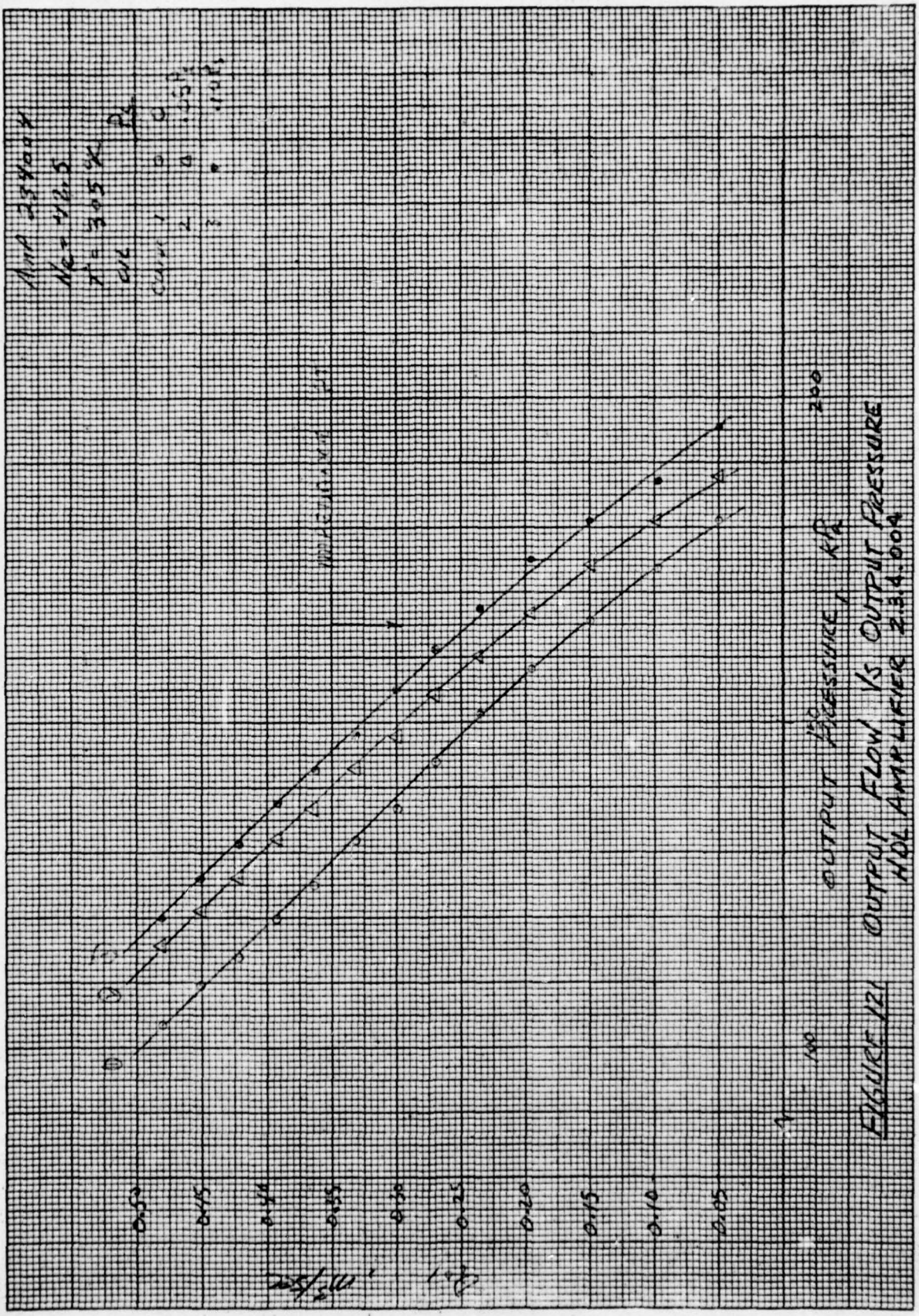



FIGURE 121 OUTPUT FLOW VS OUTPUT PRESSURE
HDL AMPLIFIER 2.34.004

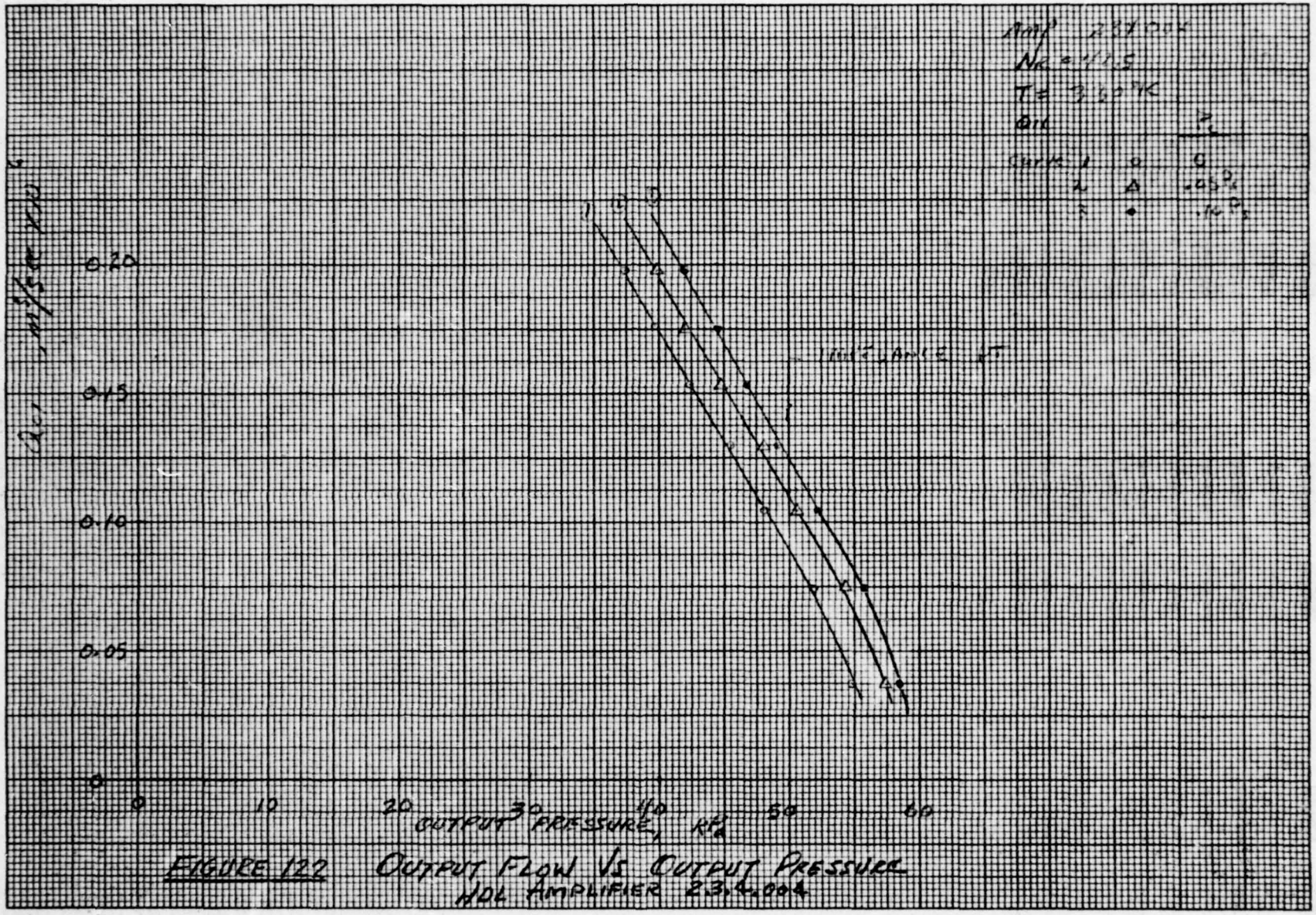



FIGURE 122 OUTPUT FLOW VS OUTPUT PRESSURE
HDL AMPLIFIER 23.4.004

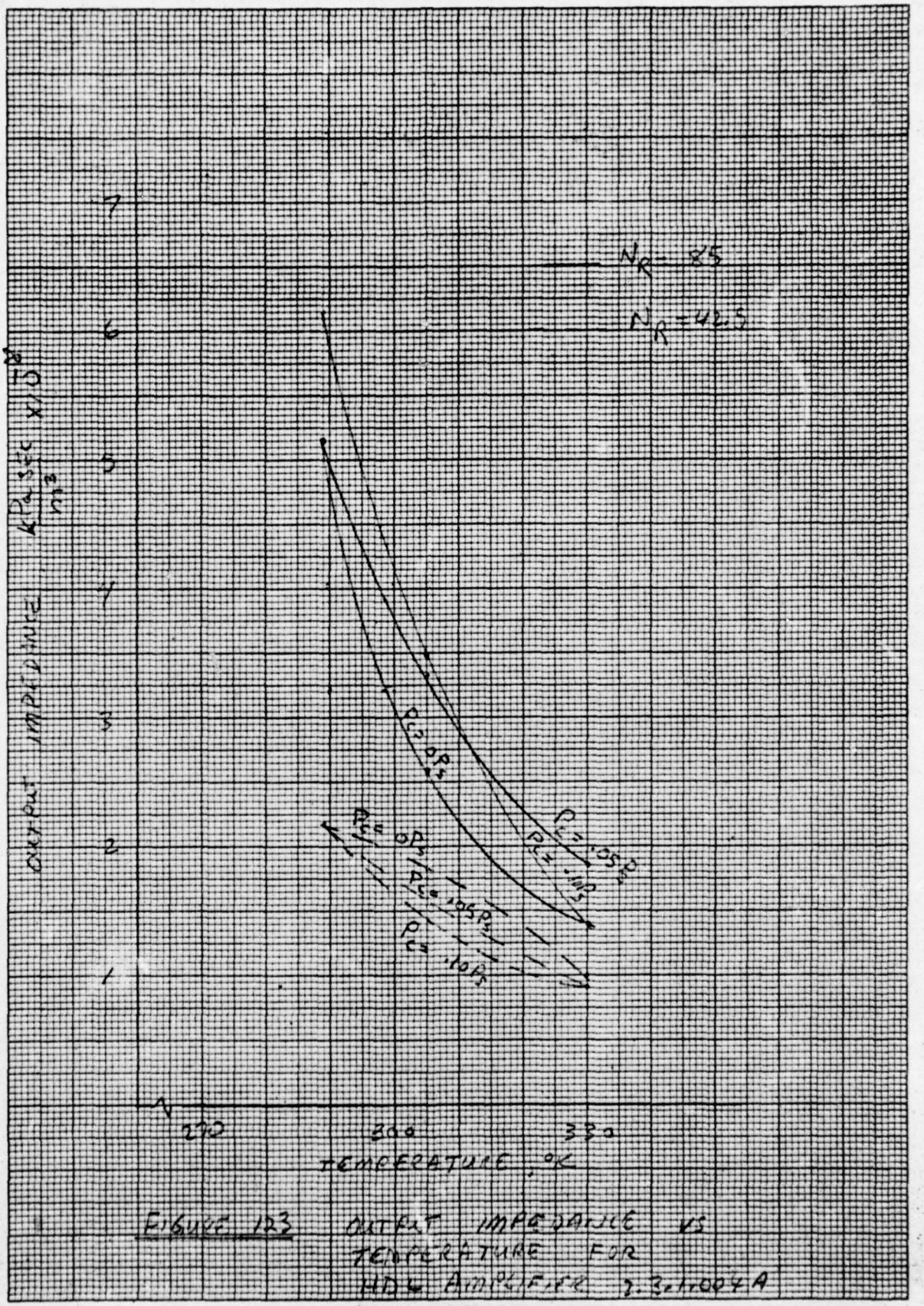



FIGURE 123 OUTPUT IMPEDANCE VS TEMPERATURE FOR HD64 AMPLIFIER 3.3+.004A

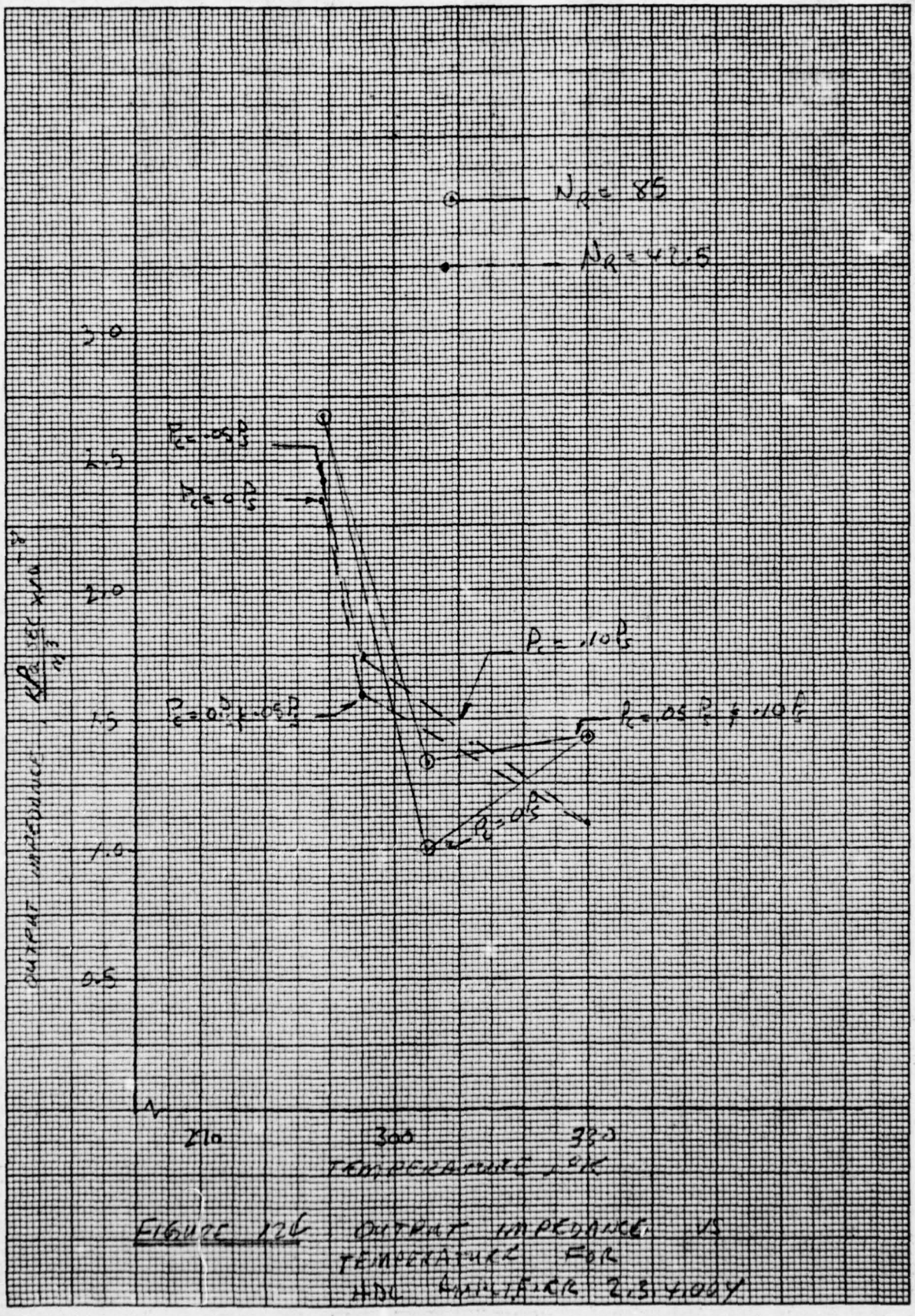



FIGURE 126 OUTPUT IMPEDANCE VS TEMPERATURE FOR HDC AMPLIFIER 2.3 ±100V

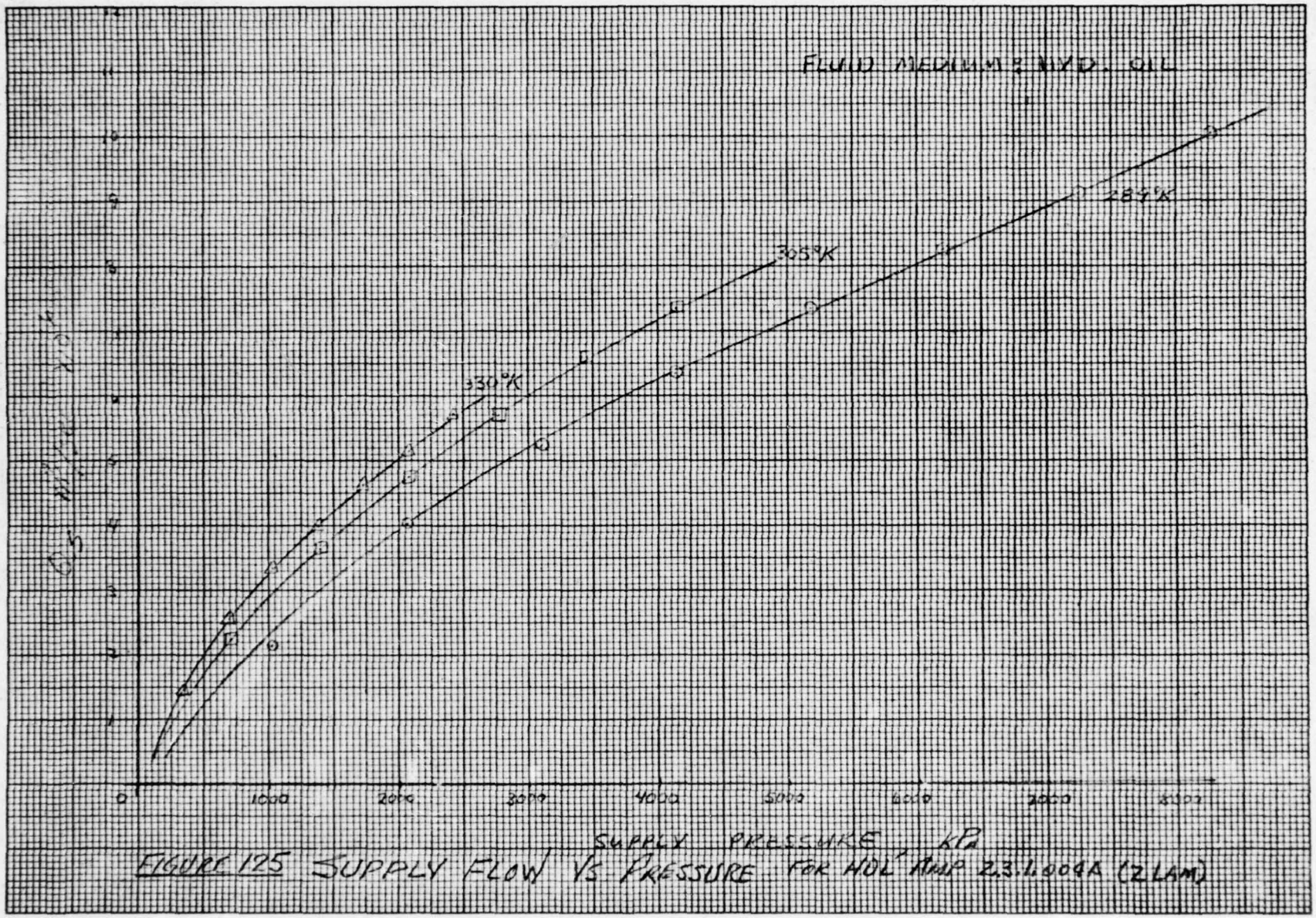



FIGURE 125 SUPPLY FLOW VS PRESSURE FOR NOZZLE ASSY 23.6004A (2 LAM)

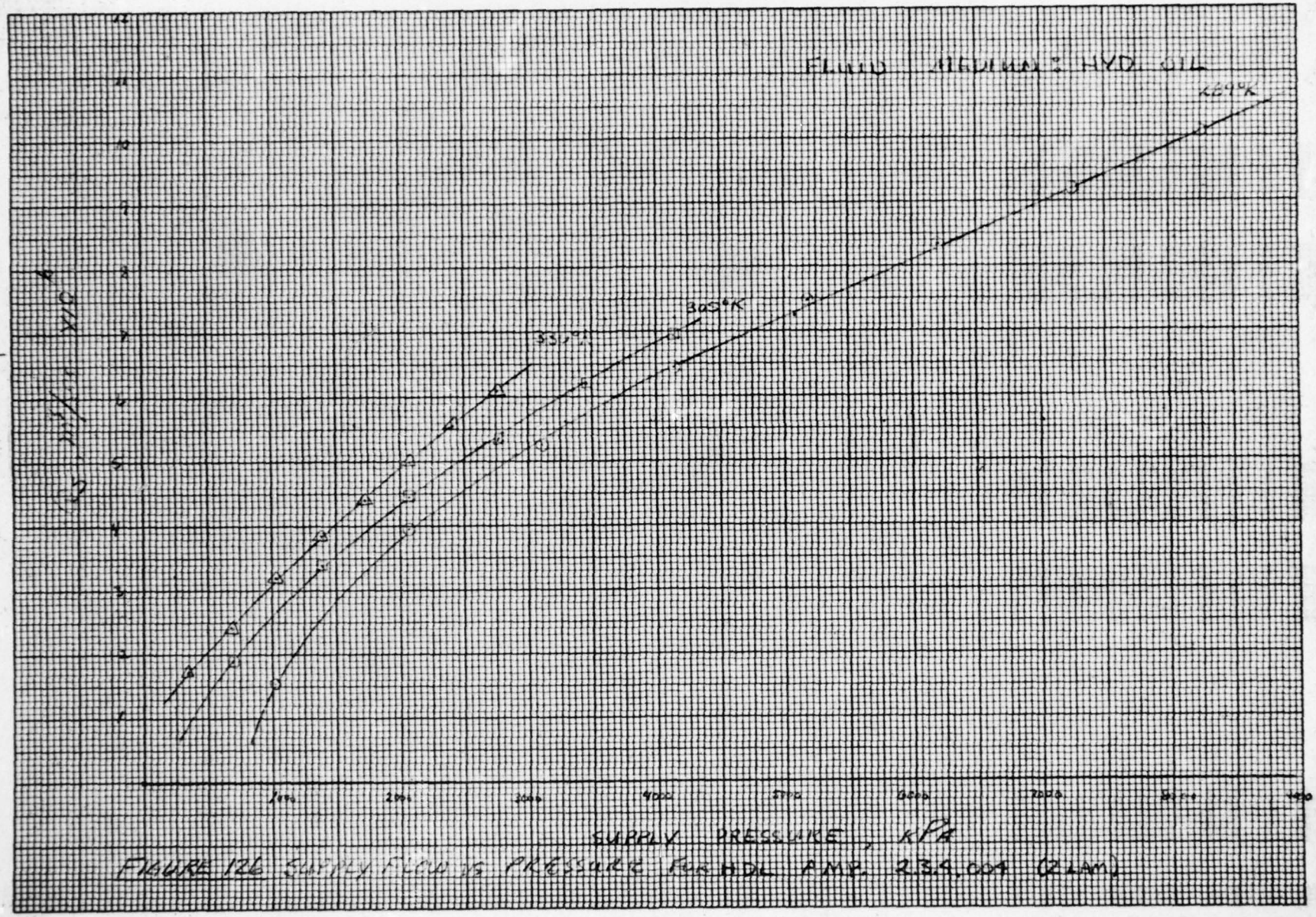



FIGURE 126 SUPPLY FLOW VS PRESSURE FOR HDL PMP. 2.3.9.004 (2 LAM.)

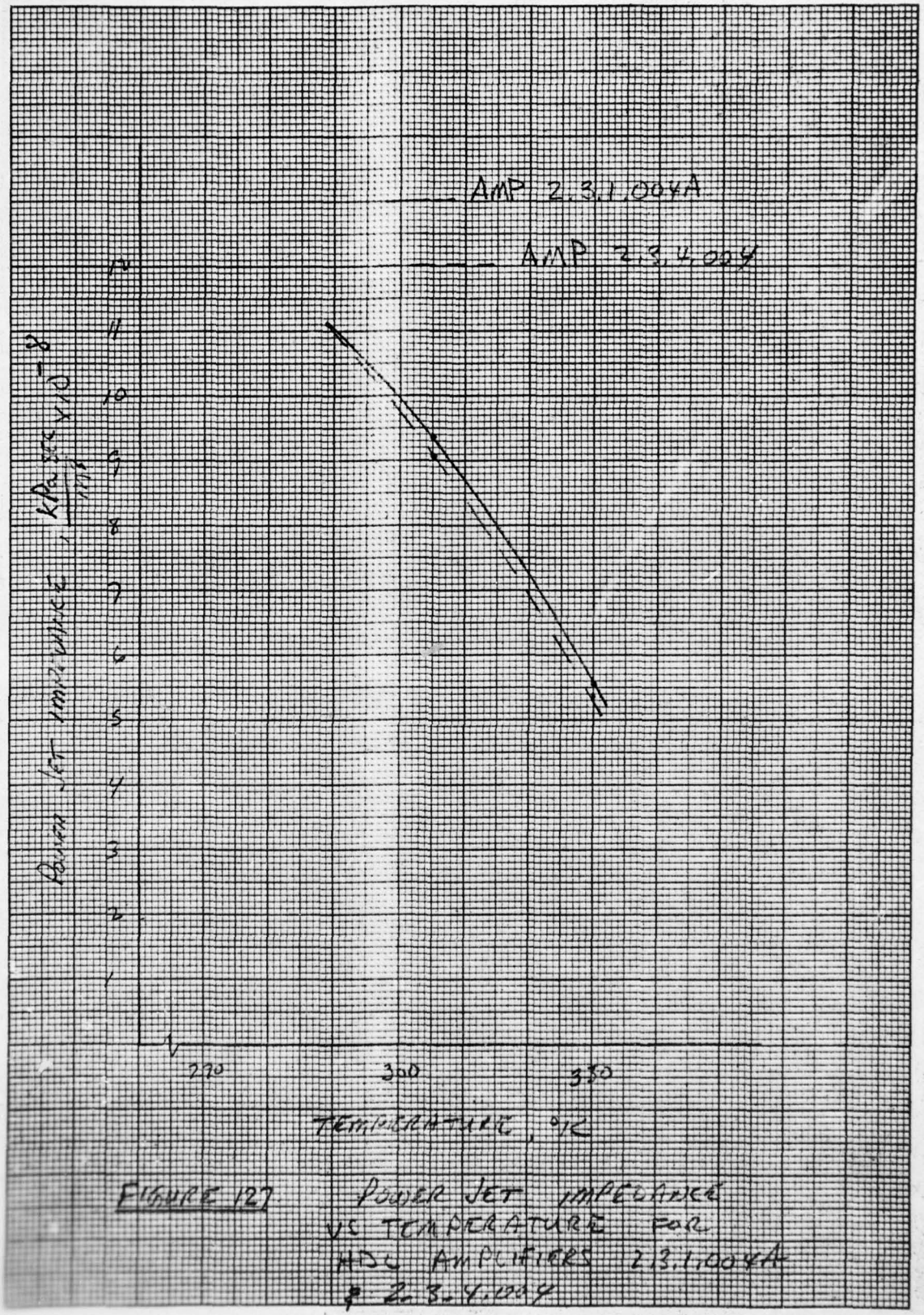



FIGURE 127 POWER JET IMPEDANCE VS TEMPERATURE FOR HDC AMPLIFIERS 2.3.1.004A & 2.3.4.004

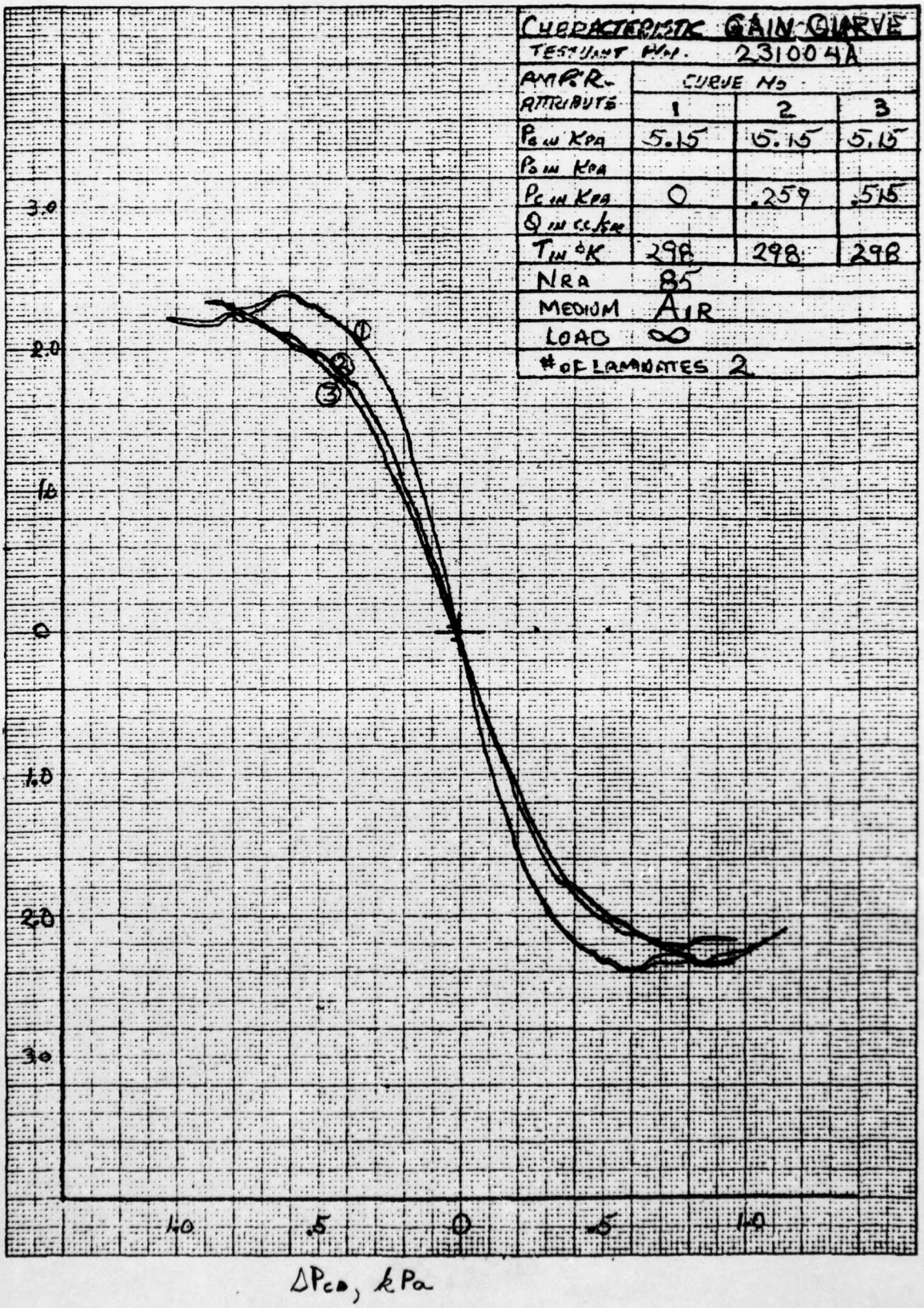
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# APPENDIX A

## AIR TEST DATA

### TABLE OF CONTENTS

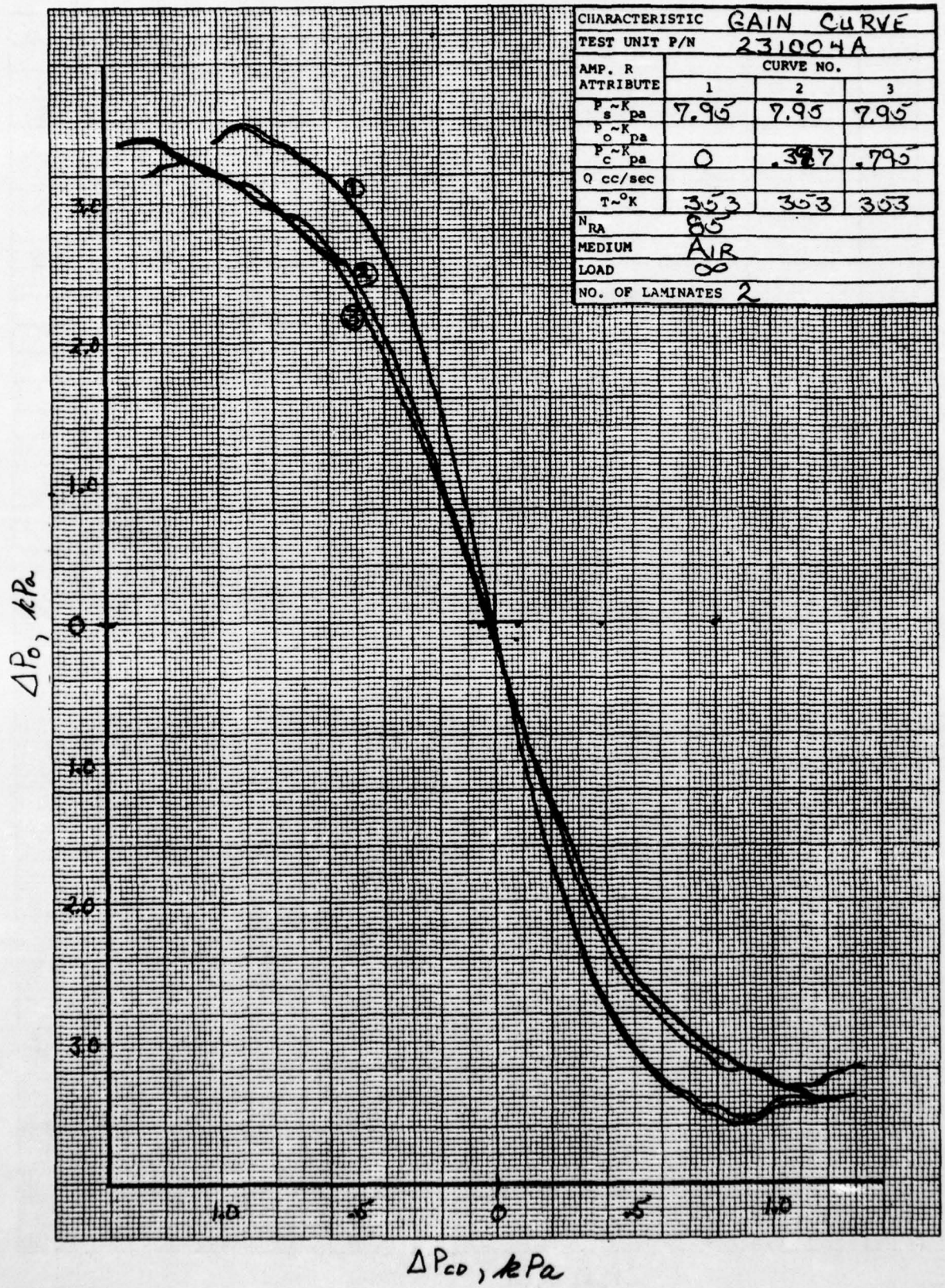

| | PAGE |
|---|---|
| GAIN, $N_R$ = CONSTANT | 179 THRU 238 |
| GAIN, $P_S$ = CONSTANT | 239 THRU 282 |
| GAIN, VIBRATION | 283 THRU 297 |
| COMMON MODE REJECTION | 299 THRU 308 |
| INPUT IMPEDANCE, CENTERED JET, $N_R$ = CONSTANT | 309 THRU 324 |
| INPUT IMPEDANCE, CENTERED JET, $P_S$ = CONSTANT | 325 THRU 340 |
| INPUT IMPEDANCE, DEFLECTED JET, $N_R$ = CONSTANT | 341 THRU 364 |
| INPUT IMPEDANCE, DEFLECTED JET, $P_S$ = CONSTANT | 365 THRU 380 |
| OUTPUT IMPEDANCE, $N_R$ = CONSTANT | 381 THRU 392 |
| OUTPUT IMPEDANCE, $P_S$ = CONSTANT | 393 THRU 404 |
| POWER JET IMPEDANCE | 405 AND 406 |

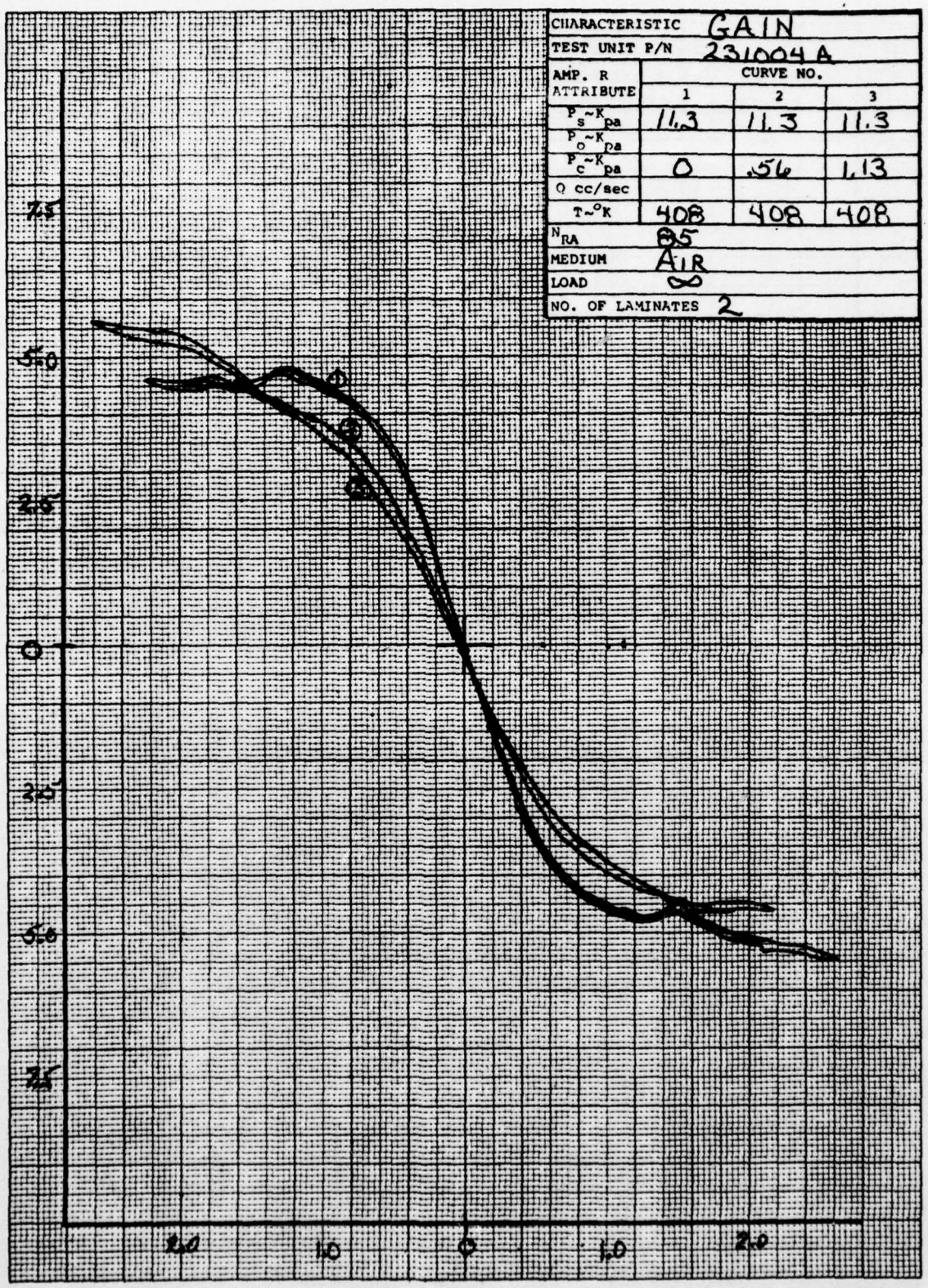


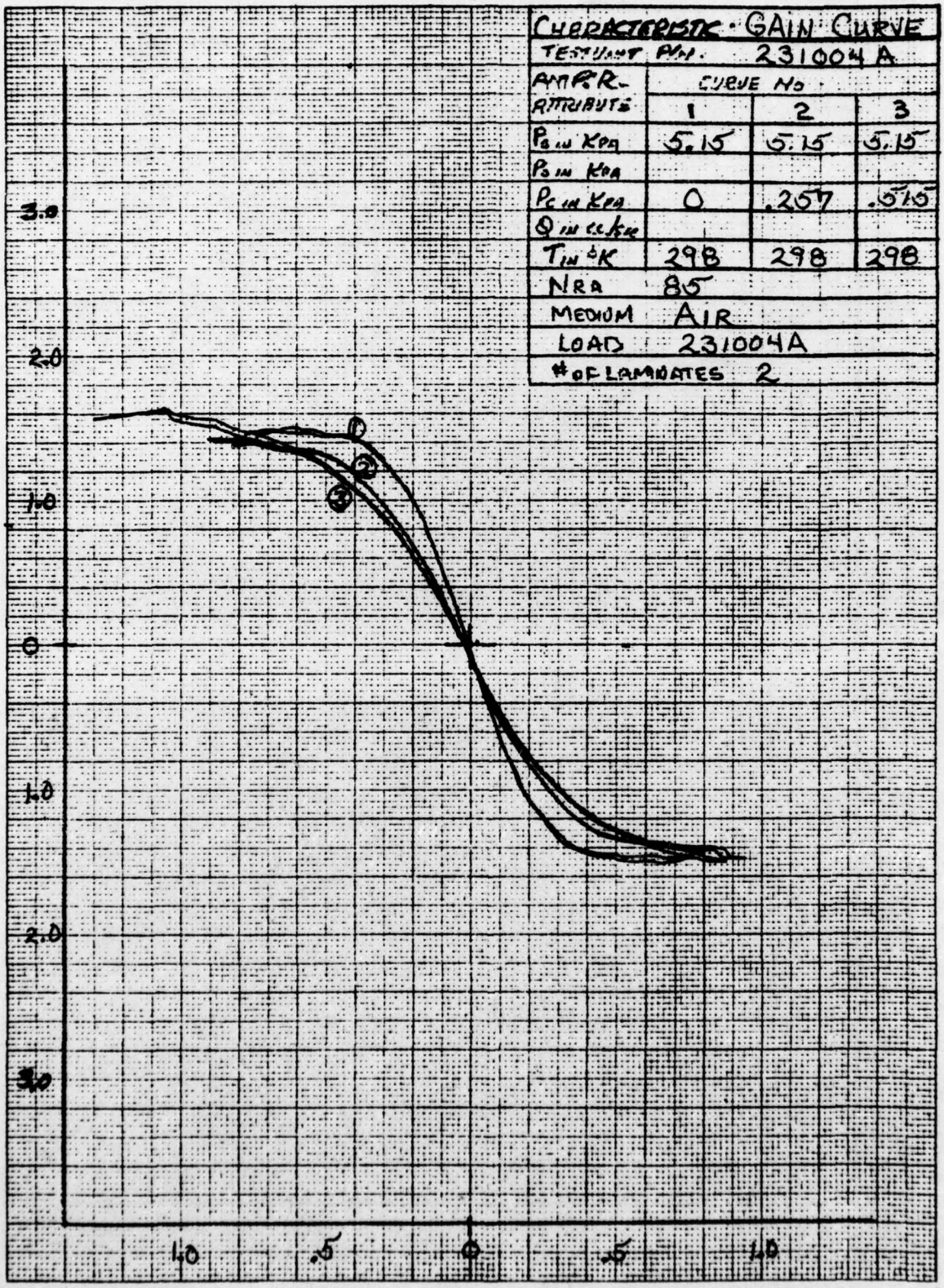


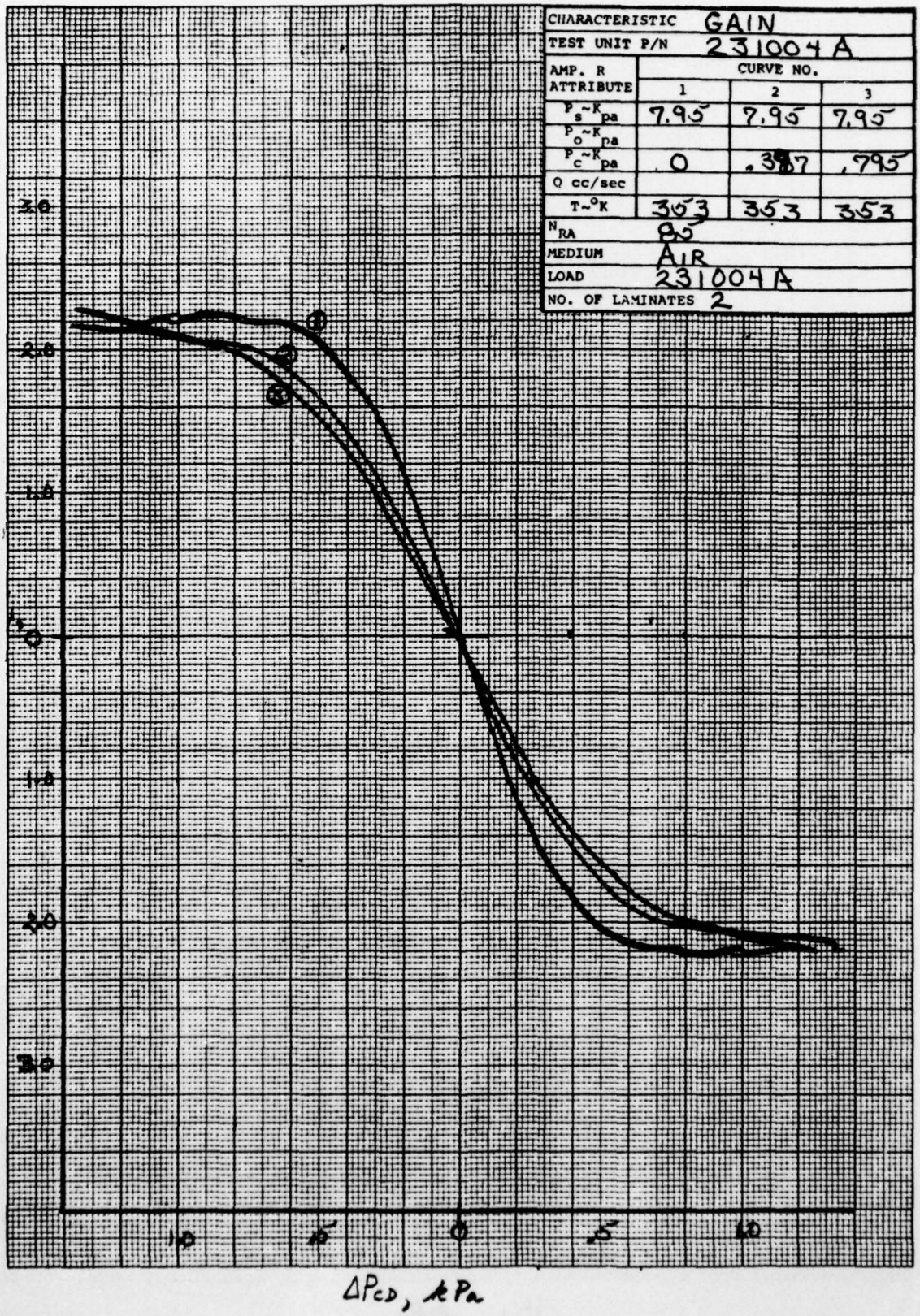

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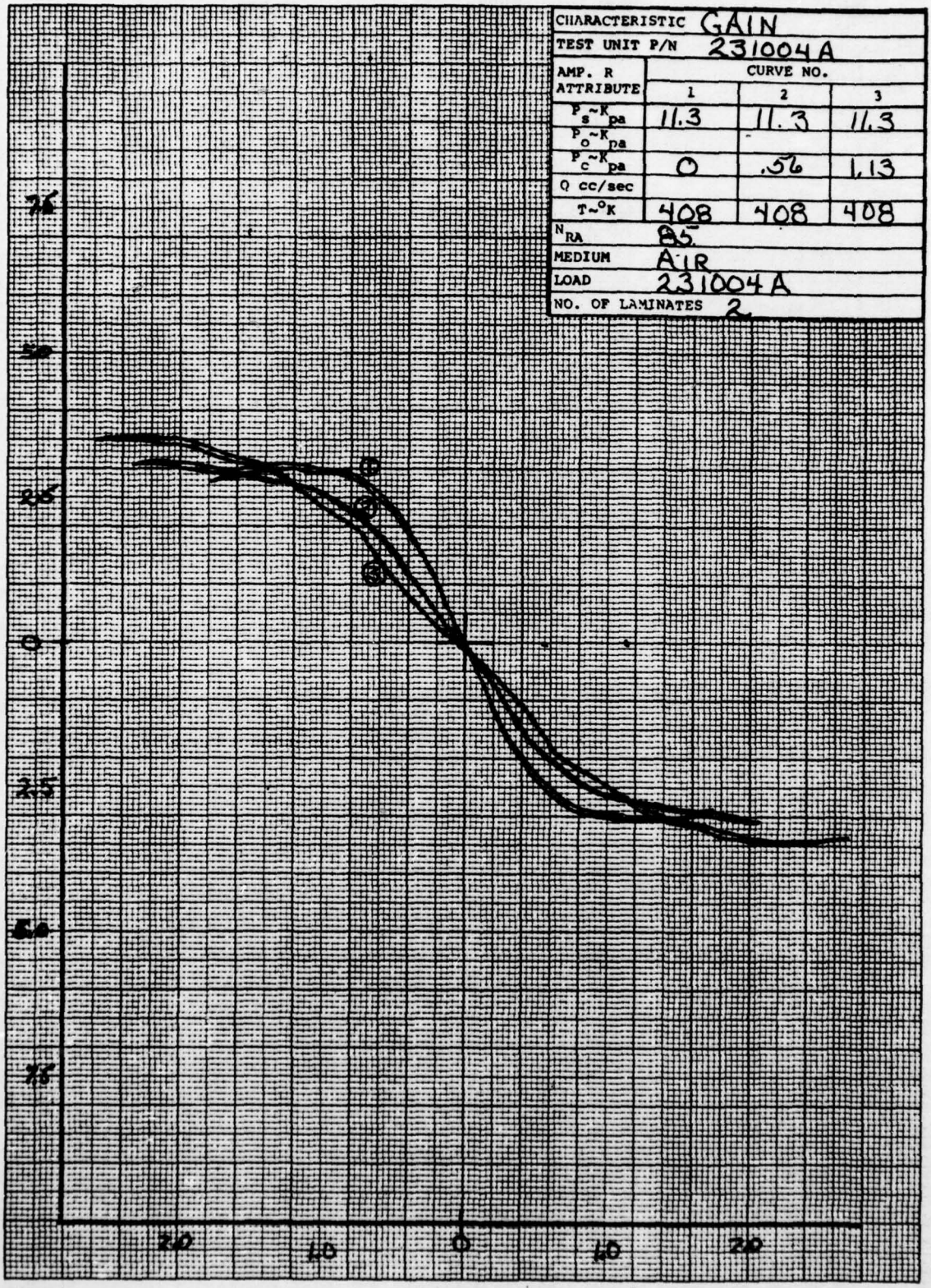
EARPRINT PAPER CO. NO. C3W MILLIMETERS BOTH WAYS 160 X 220 DIVISIONS: PRINTED IN U.S.A. ON CLEANPRINT TECHNICAL PAPER NO. 1018

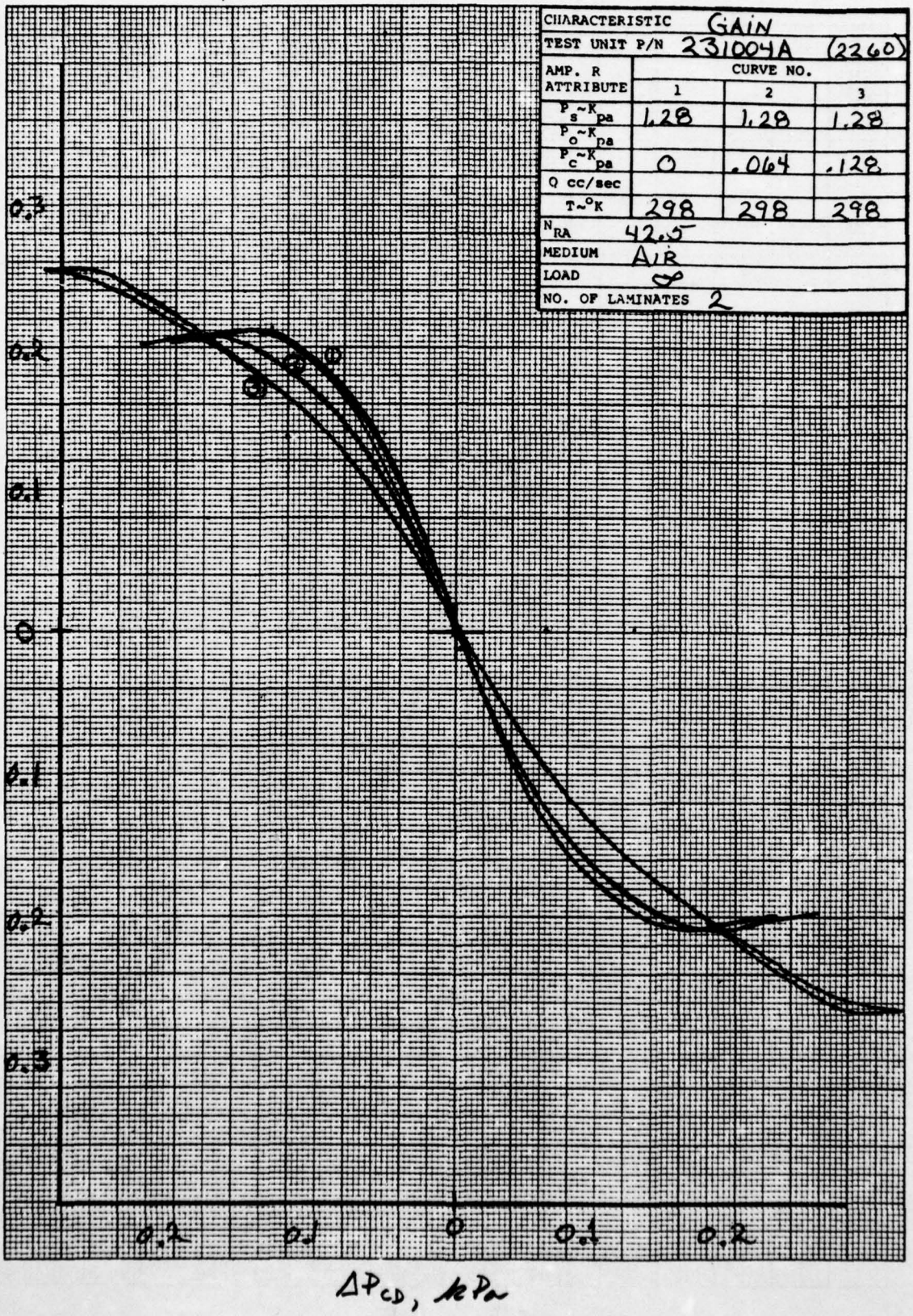

CHARACTERISTIC GAIN CURVE
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
7.95
7.95
7.95
$P_o$~K pa
$P_c$~K pa
0
.397
.795
Q cc/sec
T~°K
353
353
353
$N_{RA}$
85
MEDIUM
AIR
LOAD
∞
NO. OF LAMINATES
2
3.0
2.0
1.0
0
1.0
2.0
3.0
1.0
.5
0
.5
1.0
$\Delta P_o$, kPa
$\Delta P_{CO}$, kPa

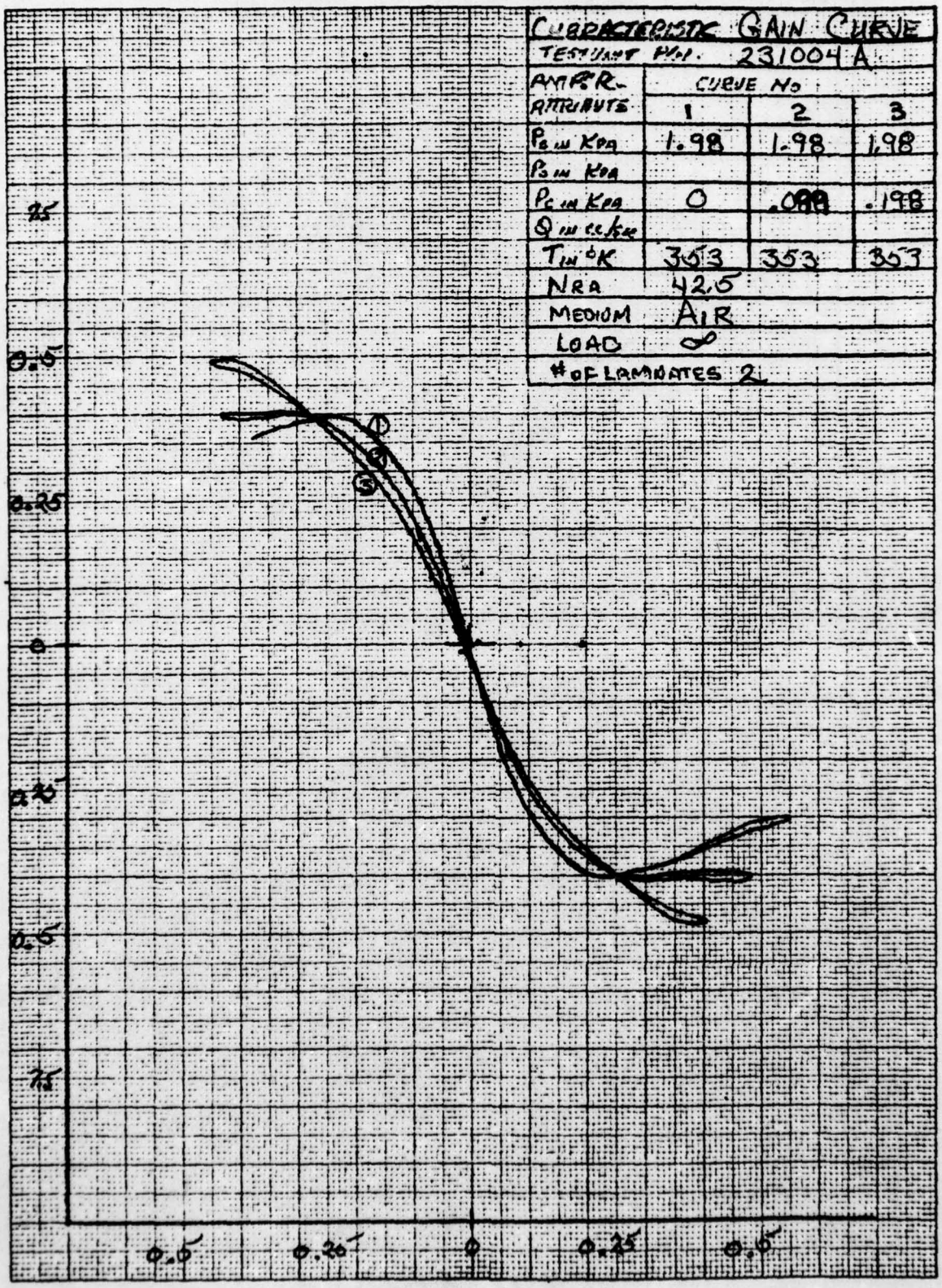

CHARACTERISTIC GAIN
TEST UNIT P/N 231004 A
AMP. R ATTRIBUTE
CURVE NO.
1 2 3
$P_s$~K pa 11.3 11.3 11.3
$P_o$~K pa
$P_c$~K pa 0 .56 1.13
Q cc/sec
T~°K 408 408 408
$N_{RA}$ 85
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
ΔPo, kPa
ΔPcD, kPa

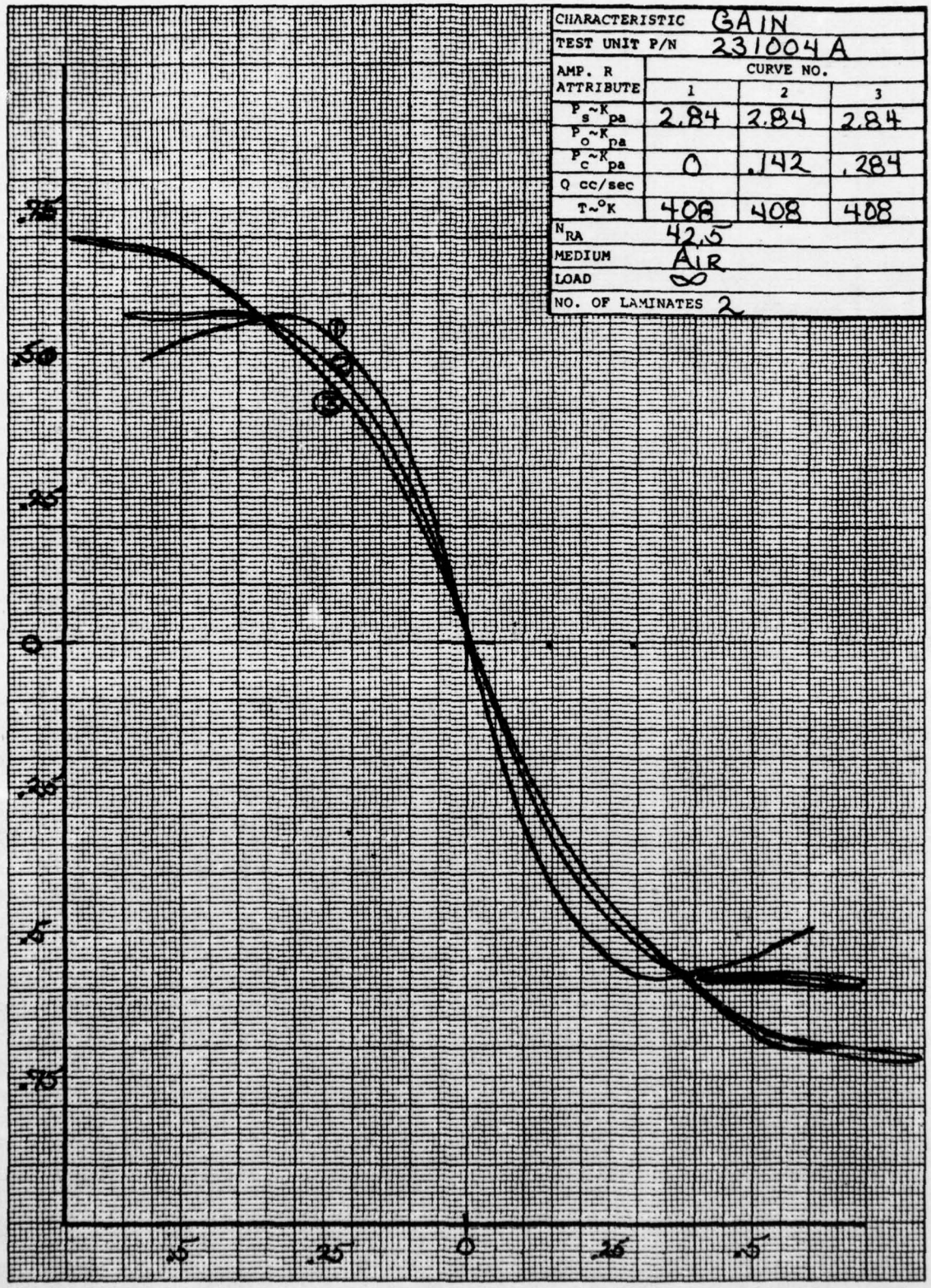

CHARACTERISTIC - GAIN CURVE
TEST UNIT P/N. 231004A
APPR. ATTRIBUTE
CURVE NO.
1
2
3
$P_a$ IN KPA 5.15 5.15 5.15
$P_b$ IN KPA
$P_c$ IN KPA 0 .257 .515
Q IN cc/sec
$T_{IN}$ °K 298 298 298
NRA 85
MEDIUM AIR
LOAD 231004A
# OF LAMINATES 2
3.0
2.0
1.0
0
1.0
2.0
3.0
1.0
.5
0
.5
1.0
$\Delta P_b$, kPa
$\Delta P_{CD}$, kPa

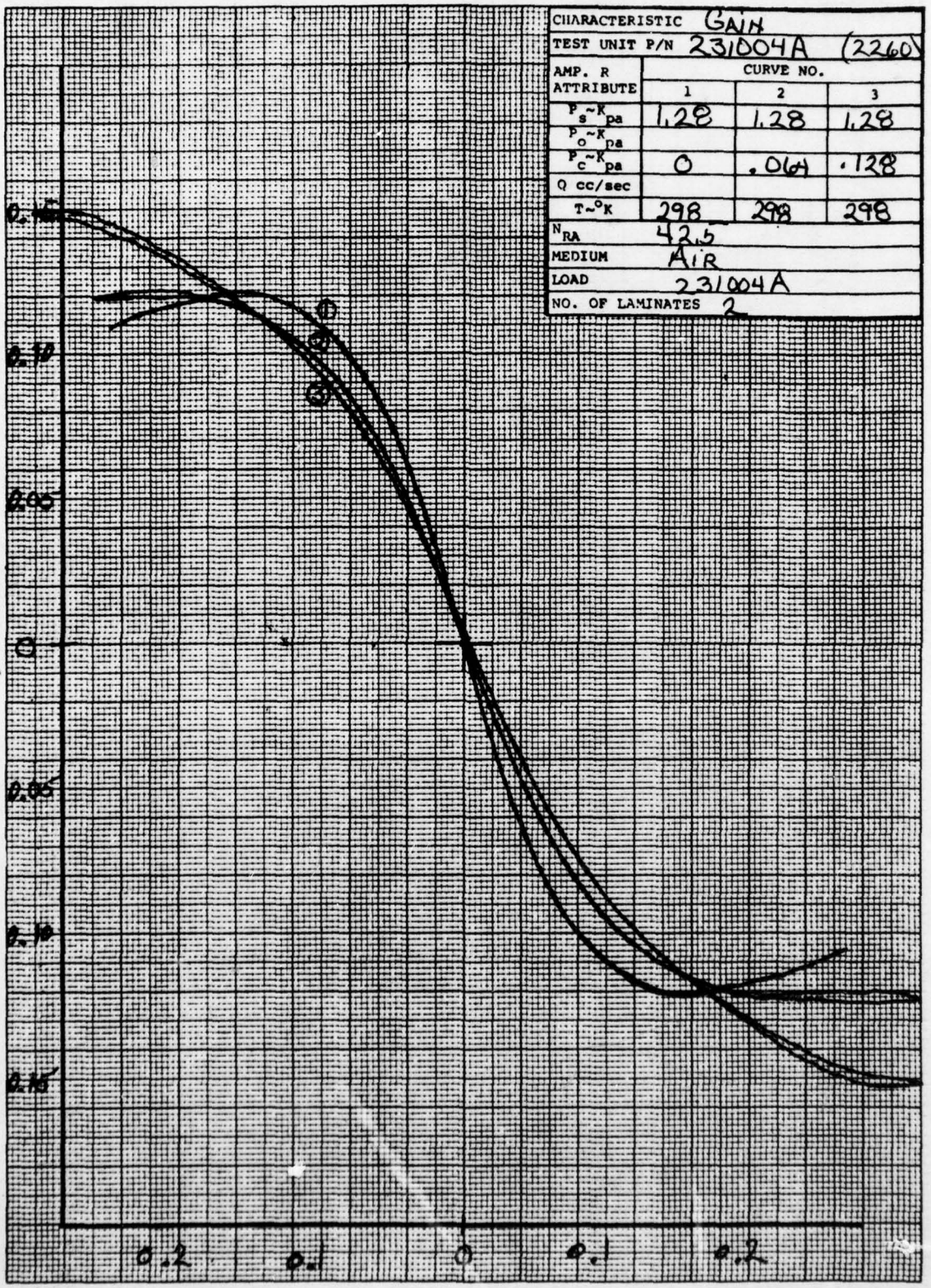

CHARACTERISTIC GAIN
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~$K_{pa}$ 7.95 7.95 7.95
$P_o$~$K_{pa}$
$P_c$~$K_{pa}$ 0 .397 .795
Q cc/sec
T~°K 353 353 353
$N_{RA}$ 80
MEDIUM AIR
LOAD 231004A
NO. OF LAMINATES 2
3.0
2.0
1.0
0
1.0
2.0
3.0
-10
-5
0
5
10
ΔP_o, kPa
ΔP_CD, kPa

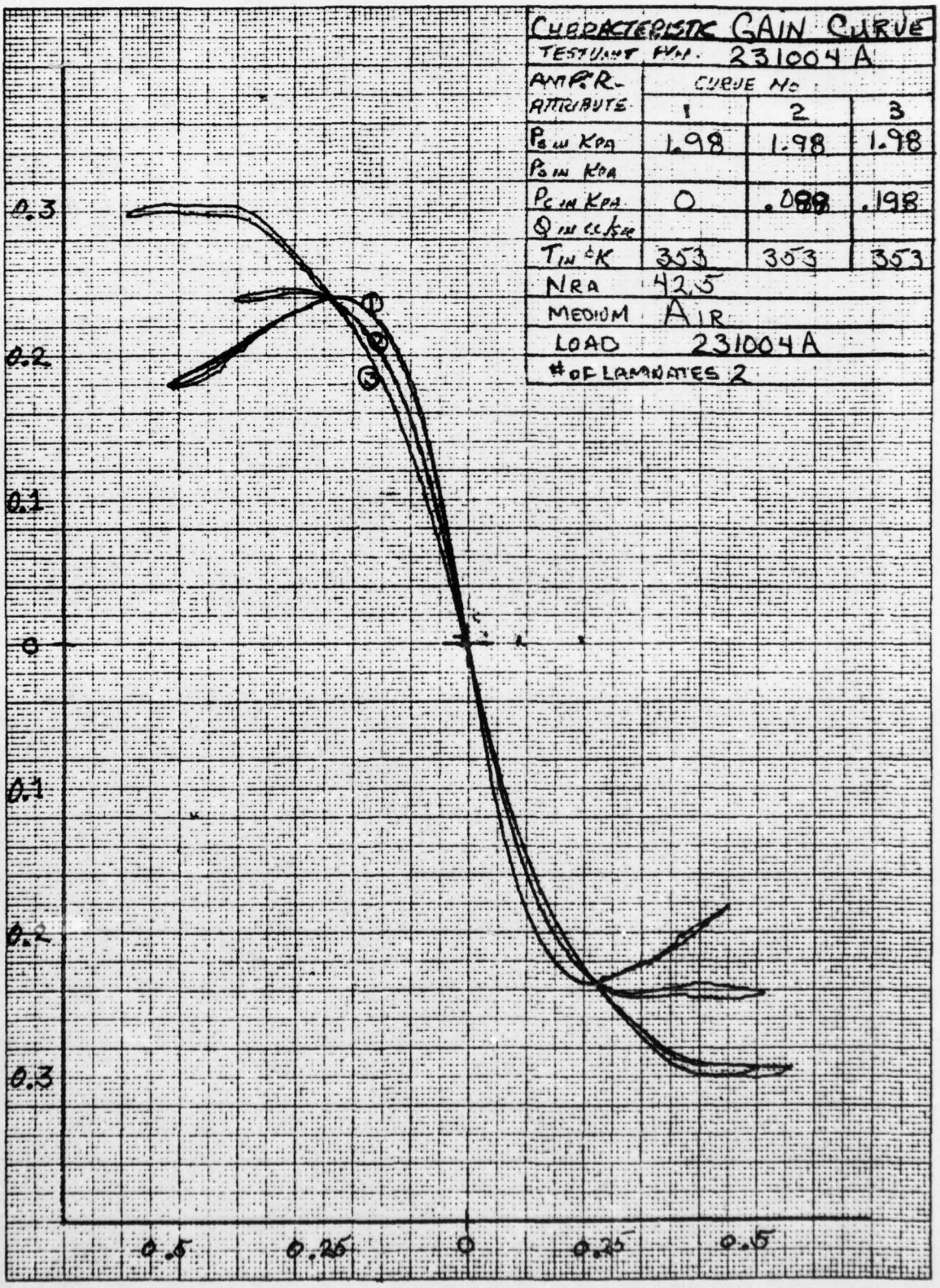

CHARACTERISTIC GAIN
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
11.3
11.3
11.3
$P_o$~K pa
$P_c$~K pa
0
.56
1.13
Q cc/sec
T~°K
408
408
408
$N_{RA}$
85
MEDIUM
AIR
LOAD
231004A
NO. OF LAMINATES
2
ΔPo, kPa
ΔPCD, kPa
40
0
40


CHARACTERISTIC GAIN
TEST UNIT P/N 231004A (2260)
AMP. R ATTRIBUTE
CURVE NO.
1 2 3
$P_s$~$K_{pa}$ 1.28 1.28 1.28
$P_o$~$K_{pa}$
$P_c$~$K_{pa}$ 0 .064 .128
Q cc/sec
T~°K 298 298 298
$N_{RA}$ 42.5
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
0.3
0.2
0.1
0
0.1
0.2
0.3
0.2
0.1
0
0.1
0.2
ΔPo, kPa
ΔPCD, kPa


CHARACTERISTIC GAIN CURVE
TEST UNIT NO. 231004 A
AMPR-ATTRIBUTE
CURVE NO
1
2
3
Ps IN KPa
1.98
1.98
1.98
Ps IN KPa
Pc IN KPa
0
.099
.198
Q IN cc/sec
TIN °K
353
353
353
NRa
42.5
MEDIUM
AIR
LOAD
∞
# OF LAMINATES 2
ΔPo, kPa
ΔPCD, kPa
0.5
0.25
0
0.25
0.5
0.5
0.25
0
0.25
0.5


CHARACTERISTIC GAIN
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO.
1 2 3
$P_s$~K$_{pa}$ 2.84 2.84 2.84
$P_o$~K$_{pa}$
$P_c$~K$_{pa}$ 0 .142 .284
Q cc/sec
T~°K 408 408 408
$N_{RA}$ 42.5
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
ΔP$_o$, kPa
ΔP$_{CD}$, kPa

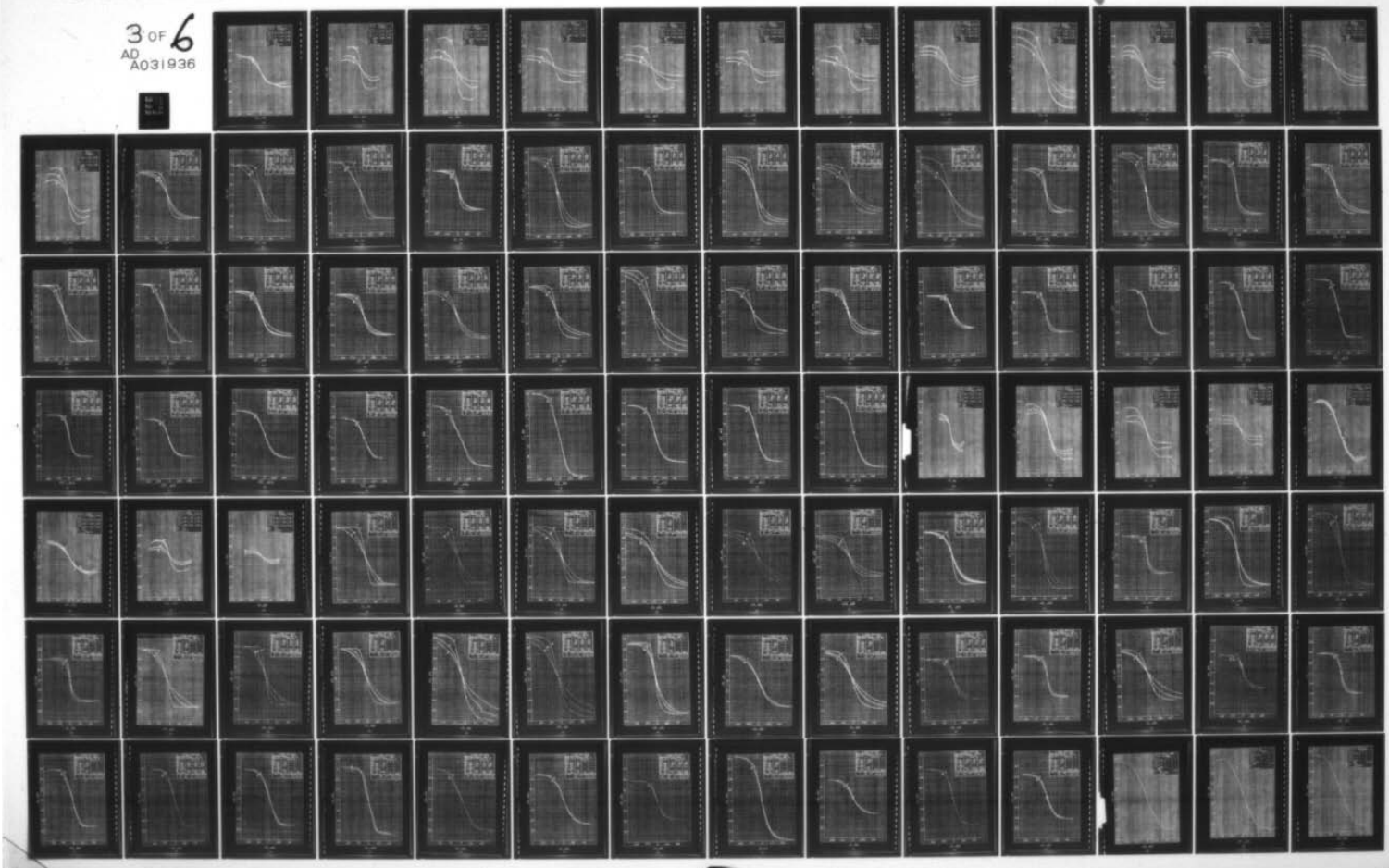

CHARACTERISTIC GAIN
TEST UNIT P/N 231004A (2260)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
1.28
1.28
1.28
$P_o$~K pa
$P_c$~K pa
0
.064
.128
Q cc/sec
T~°K
298
298
298
$N_{RA}$
42.5
MEDIUM
AIR
LOAD
231004A
NO. OF LAMINATES
2
ΔP₀, kPa
0.15
0.10
0.05
0
0.05
0.10
0.15
0.2
0.1
0
0.1
0.2
ΔP_CD, kPa




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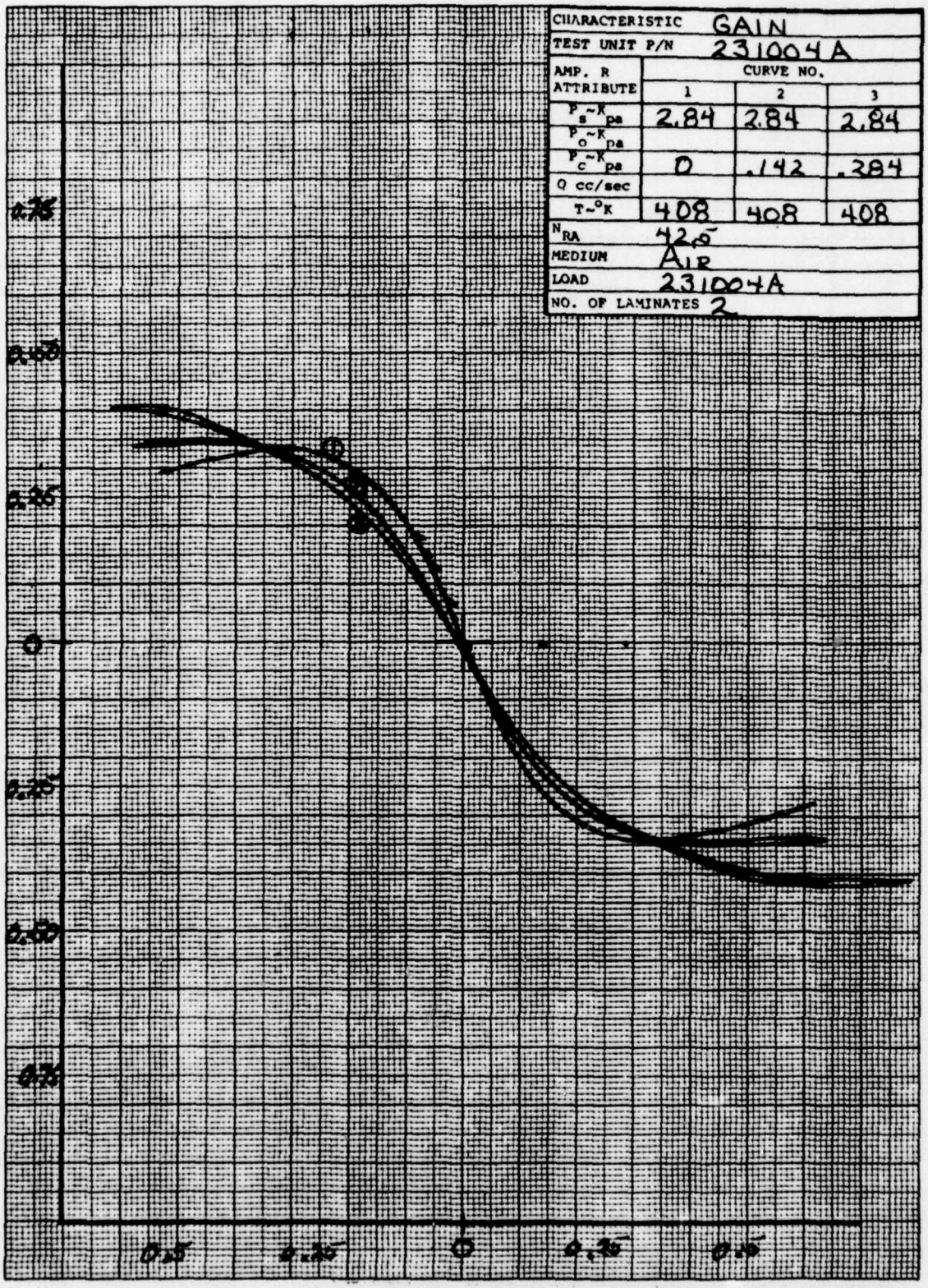
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ENVIRONMENTAL TEST PROGRAM FOR EVALUATION OF FLUIDIC ELEMENTS F--ETC(U)
DEC 75 M F CYCON, T G SUTTON, H R GAMBLE DAAG39-74-C-0187
UNCLASSIFIED 75-411145 HDL-CR-75-187-1 NL

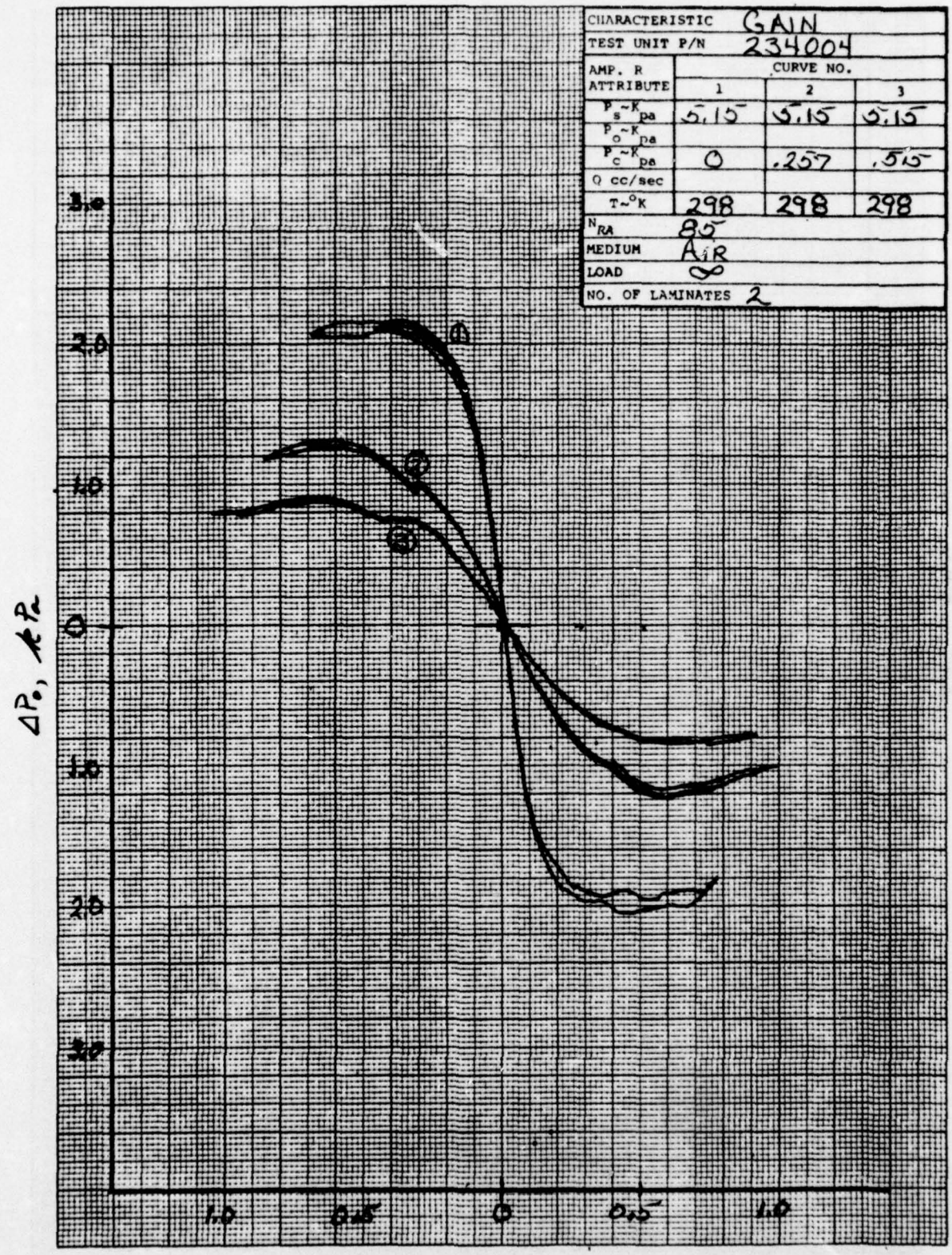
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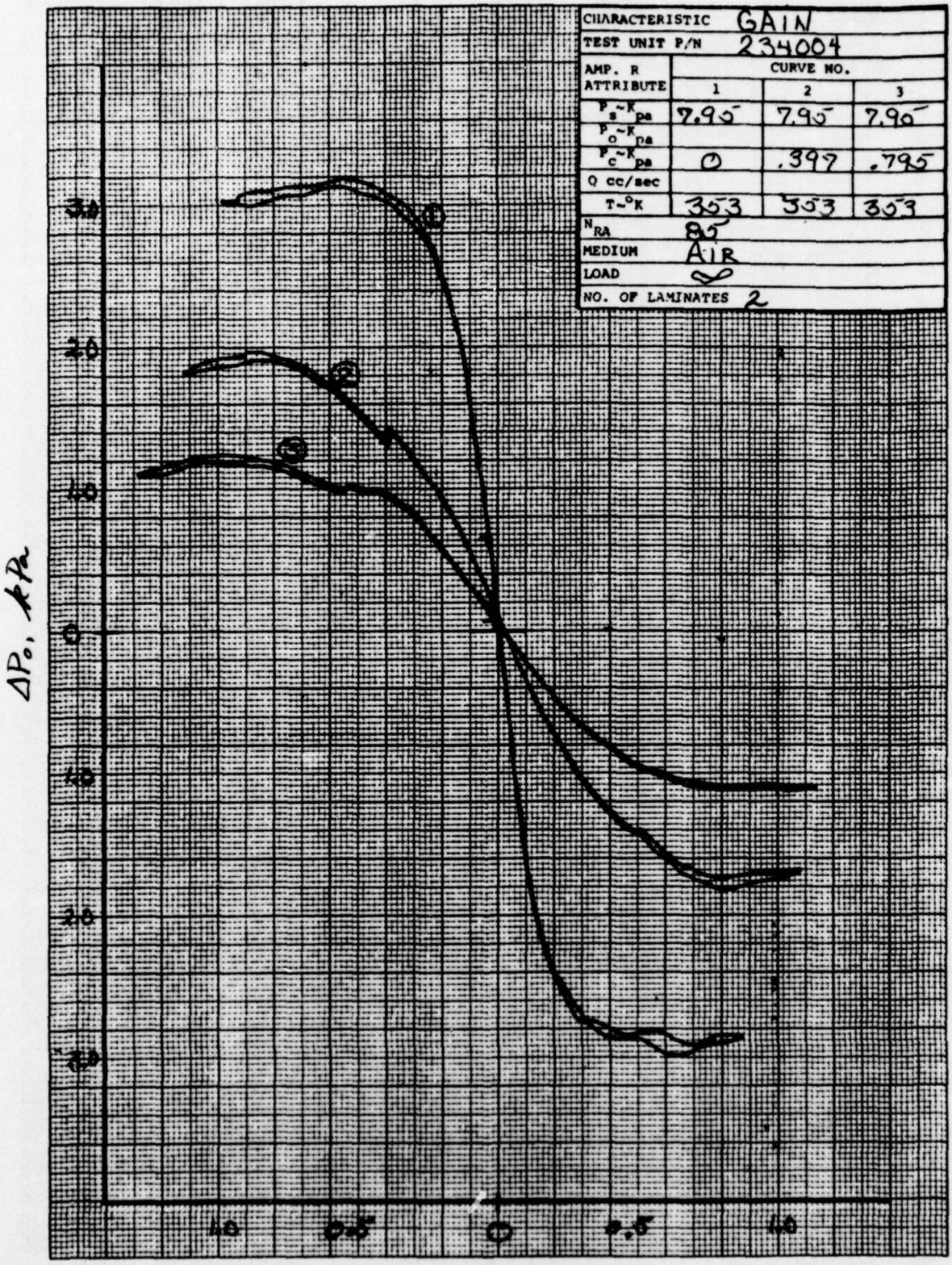


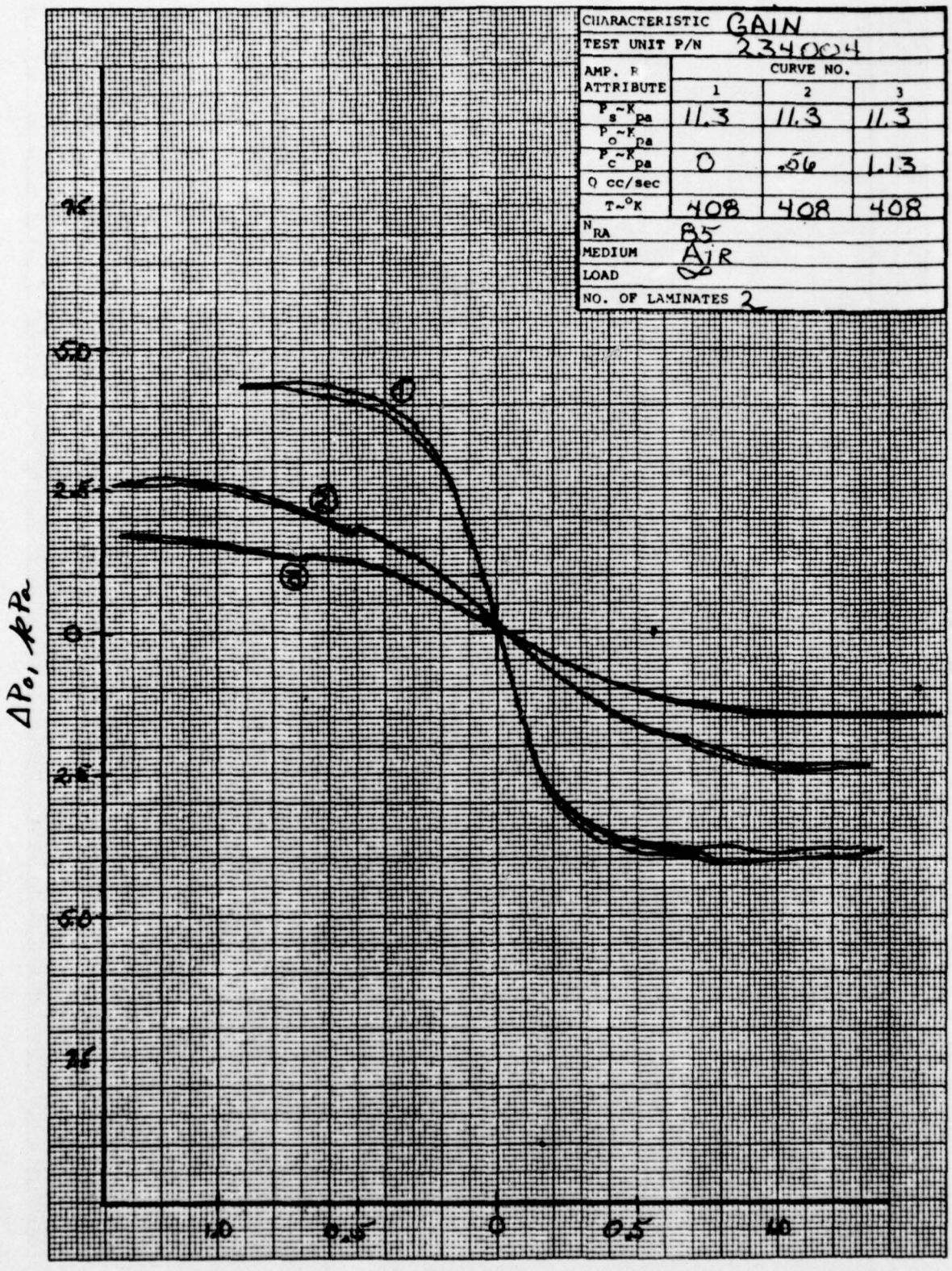
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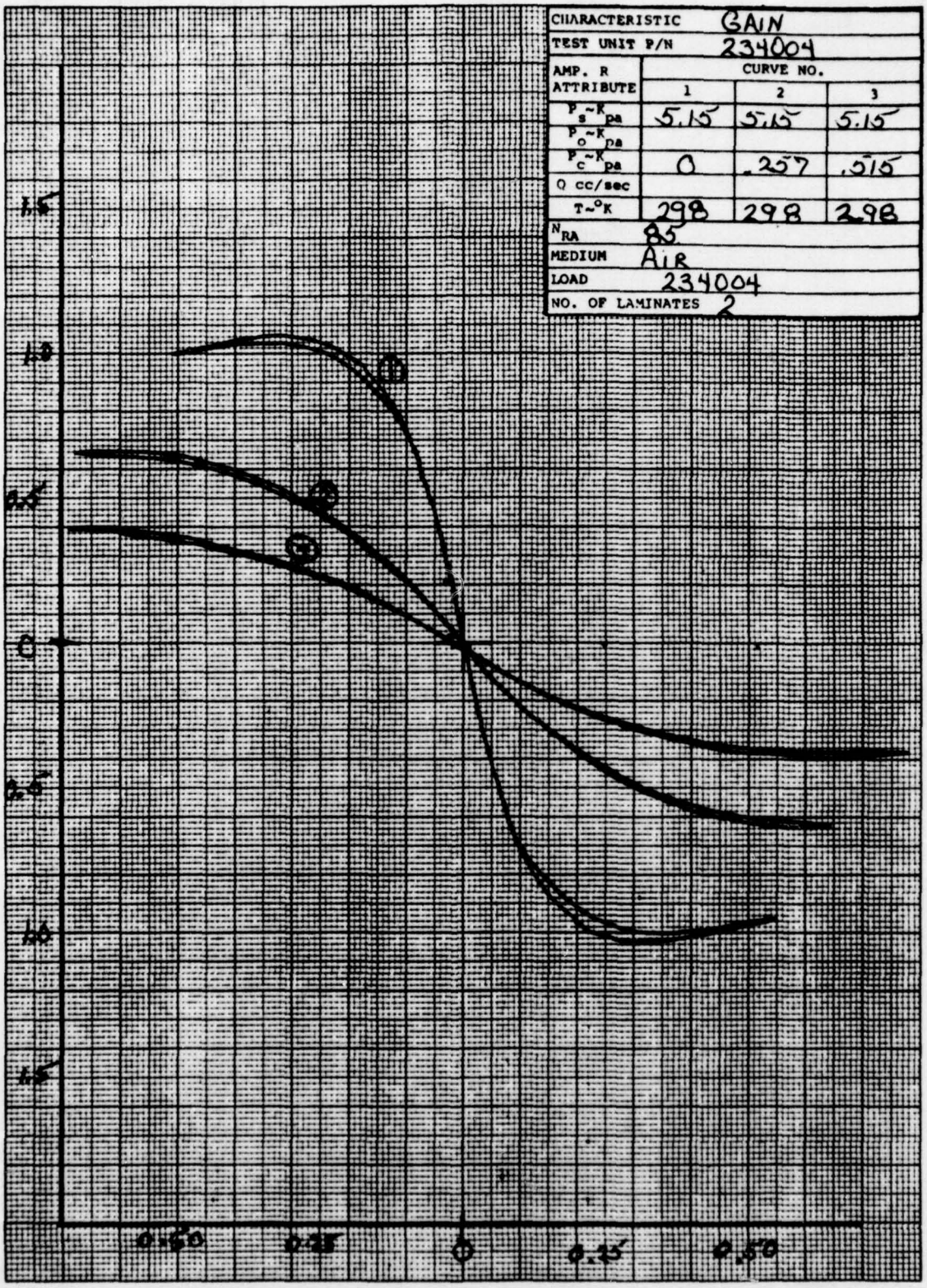


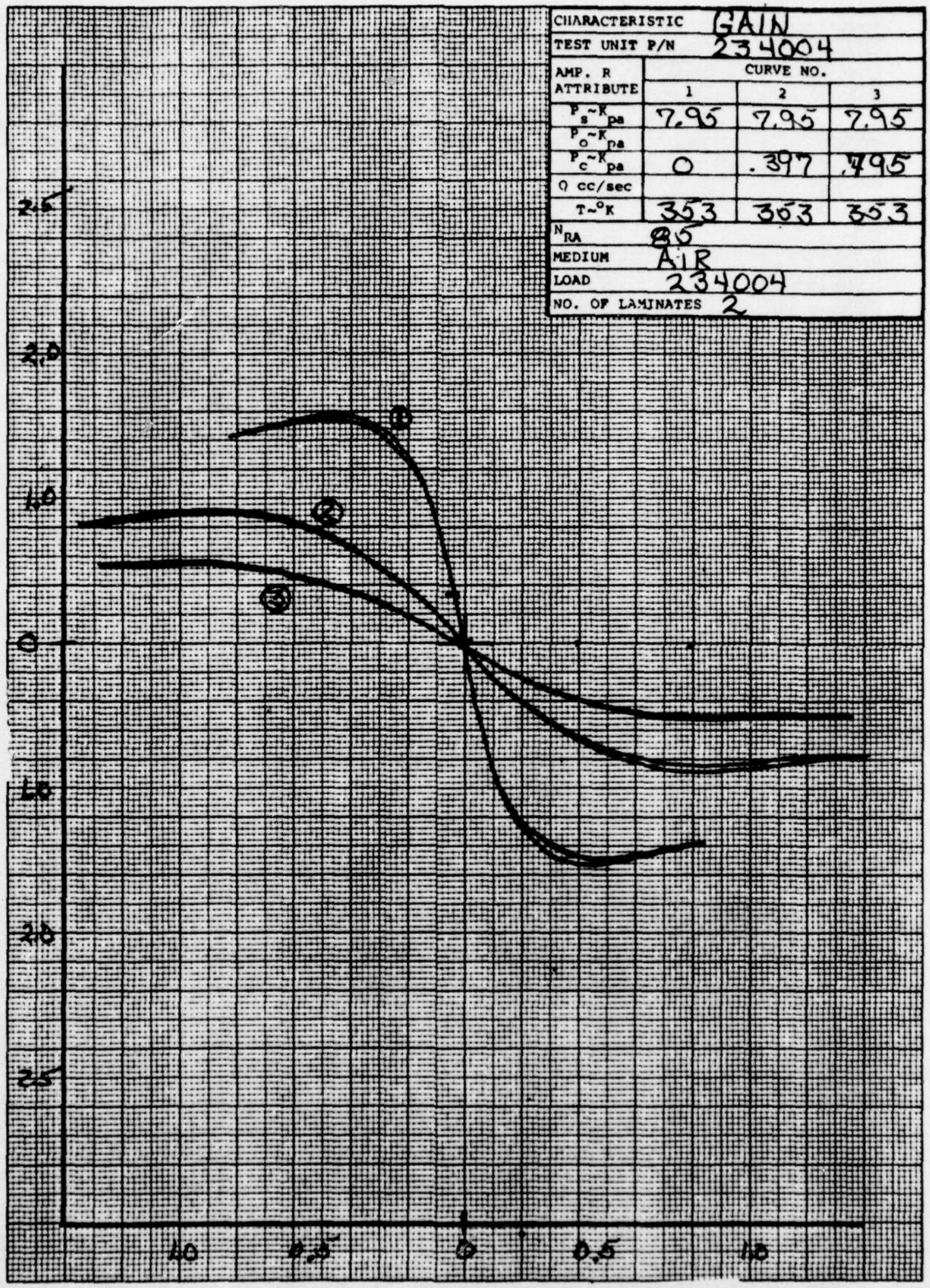

CHARACTERISTIC GAIN
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~Kpa 2.84 2.84 2.84
$P_o$~Kpa
$P_c$~Kpa 0 .142 .384
Q cc/sec
T~°K 408 408 408
$N_{RA}$ 42.5
MEDIUM AIR
LOAD 231004A
NO. OF LAMINATES 2
0.75
0.50
0.25
0
0.25
0.50
0.75
0.25
0.20
0
0.20
0.25
$\Delta P_o$, kPa
$\Delta P_{CD}$, kPa

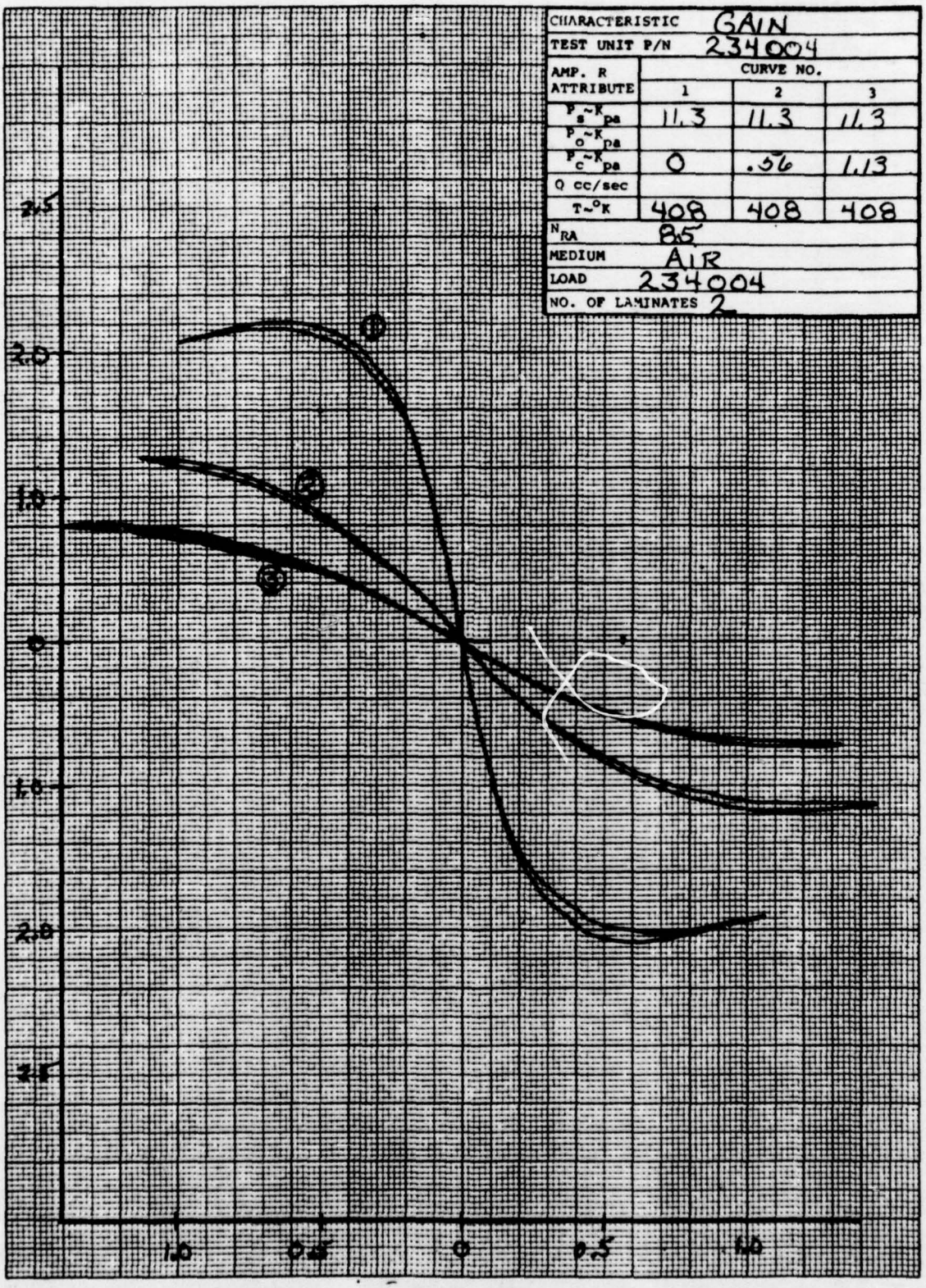

CHARACTERISTIC GAIN
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$ ~ KPa 5.15 5.15 5.15
$P_o$ ~ KPa
$P_c$ ~ KPa 0 .257 .515
Q cc/sec
T ~ °K 298 298 298
$N_{RA}$ 85
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
3.0
2.0
1.0
0
1.0
2.0
3.0
1.0
0.5
0
0.5
1.0
ΔP₀, kPa
ΔP_CD, kPa

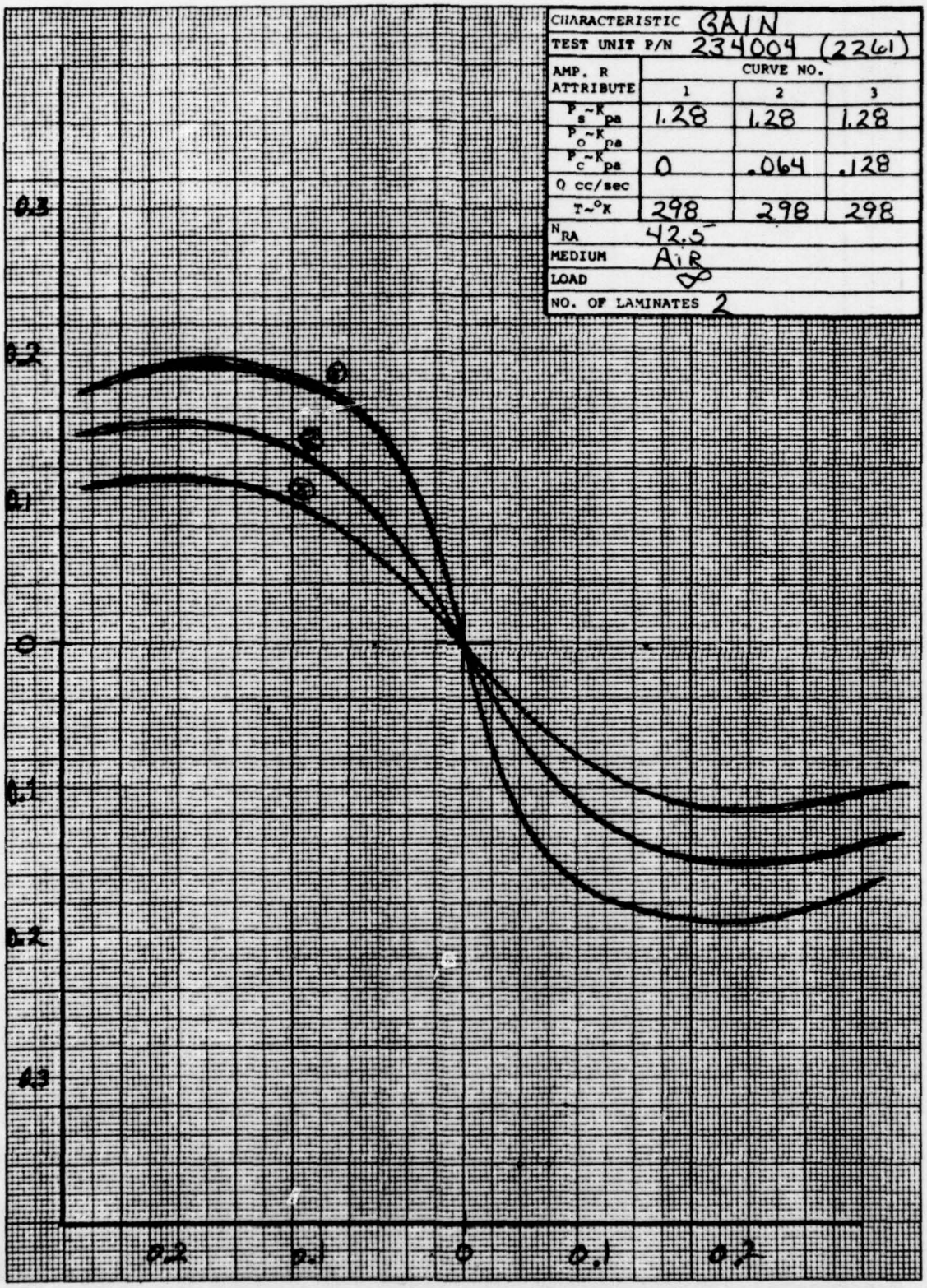

CHARACTERISTIC GAIN
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
7.90
7.90
7.90
$P_o$~K pa
$P_c$~K pa
0
.397
.795
Q cc/sec
T~°K
303
303
303
$N_{RA}$
80
MEDIUM
AIR
LOAD
NO. OF LAMINATES 2
30
20
10
0
10
20
30
1.0
0.5
0
0.5
1.0
ΔPo, kPa
ΔPcD, kPa

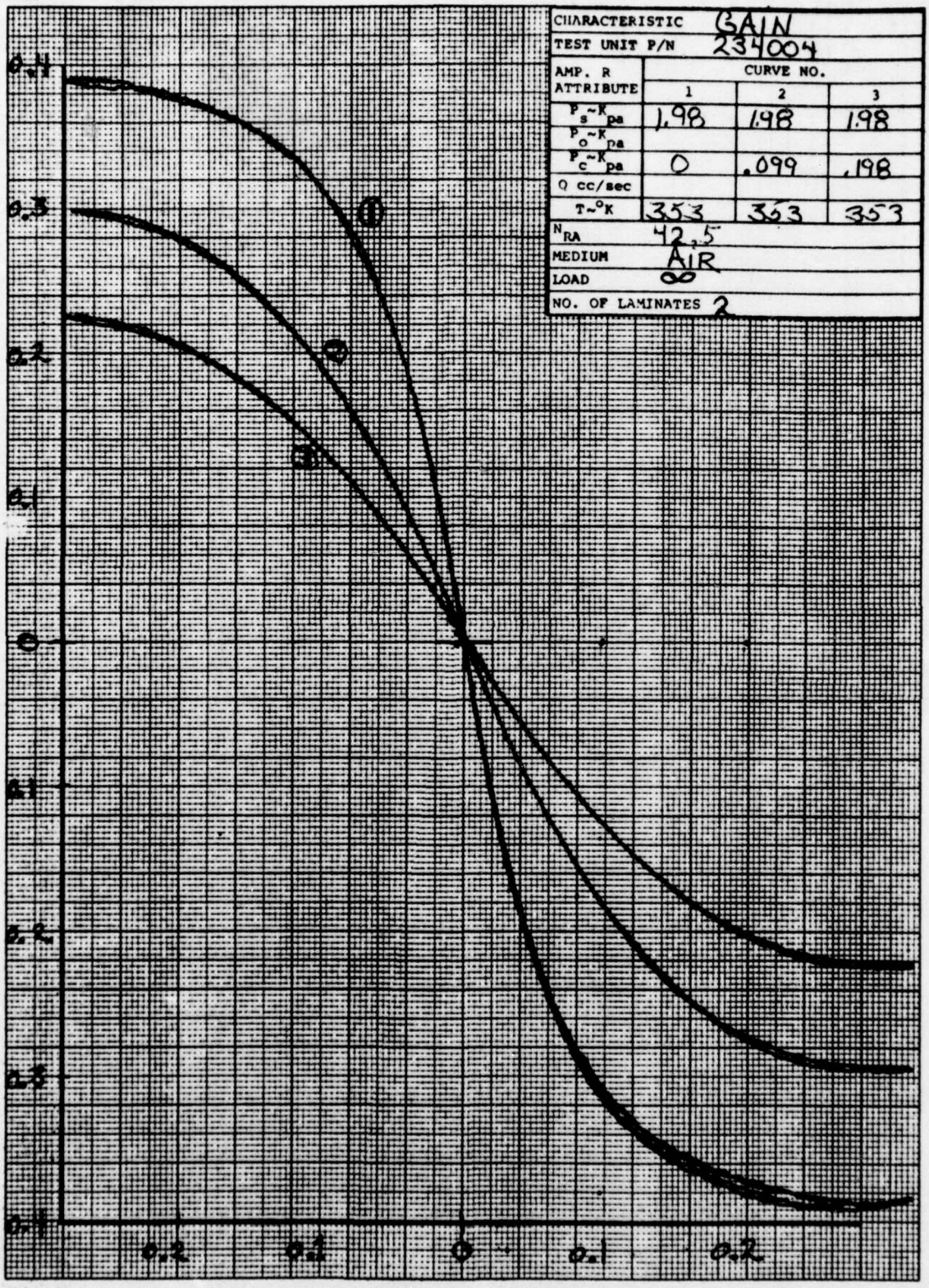

CHARACTERISTIC GAIN
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1 2 3
$P_s$~K pa 11.3 11.3 11.3
$P_o$~K pa
$P_c$~K pa 0 .56 1.13
Q cc/sec
T~°K 408 408 408
$N_{RA}$ 85
MEDIUM AIR
LOAD
NO. OF LAMINATES 2
ΔPo, kPa
ΔPcD, kPa
1.0
0.5
0
0.5
1.0

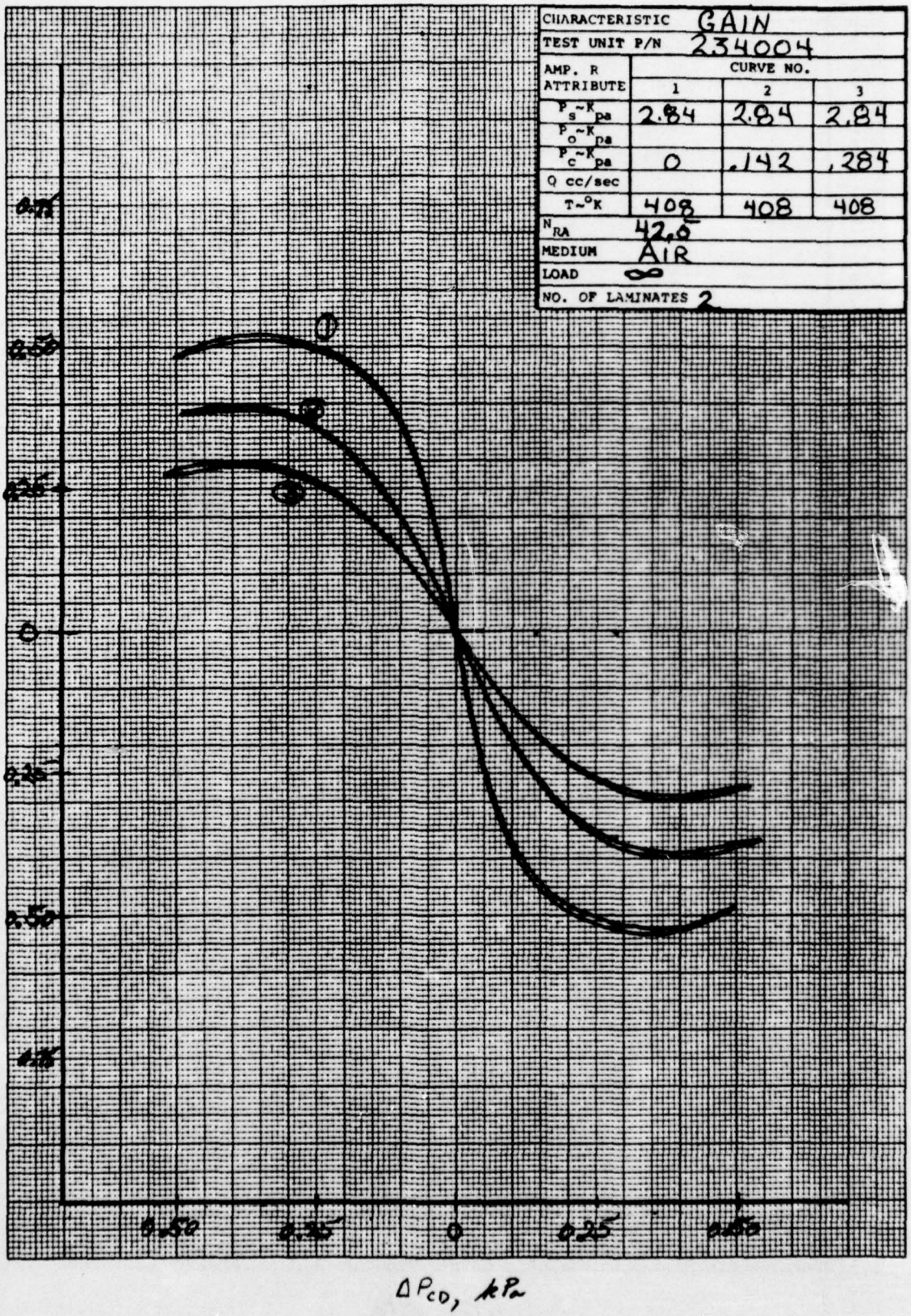

CHARACTERISTIC GAIN
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa 5.15 5.15 5.15
$P_o$~K pa
$P_c$~K pa 0 .257 .515
Q cc/sec
T~°K 298 298 298
$N_{RA}$ 85
MEDIUM AIR
LOAD 234004
NO. OF LAMINATES 2
ΔPo, kPa
ΔPco, kPa
0.50
0.25
0
0.25
0.50

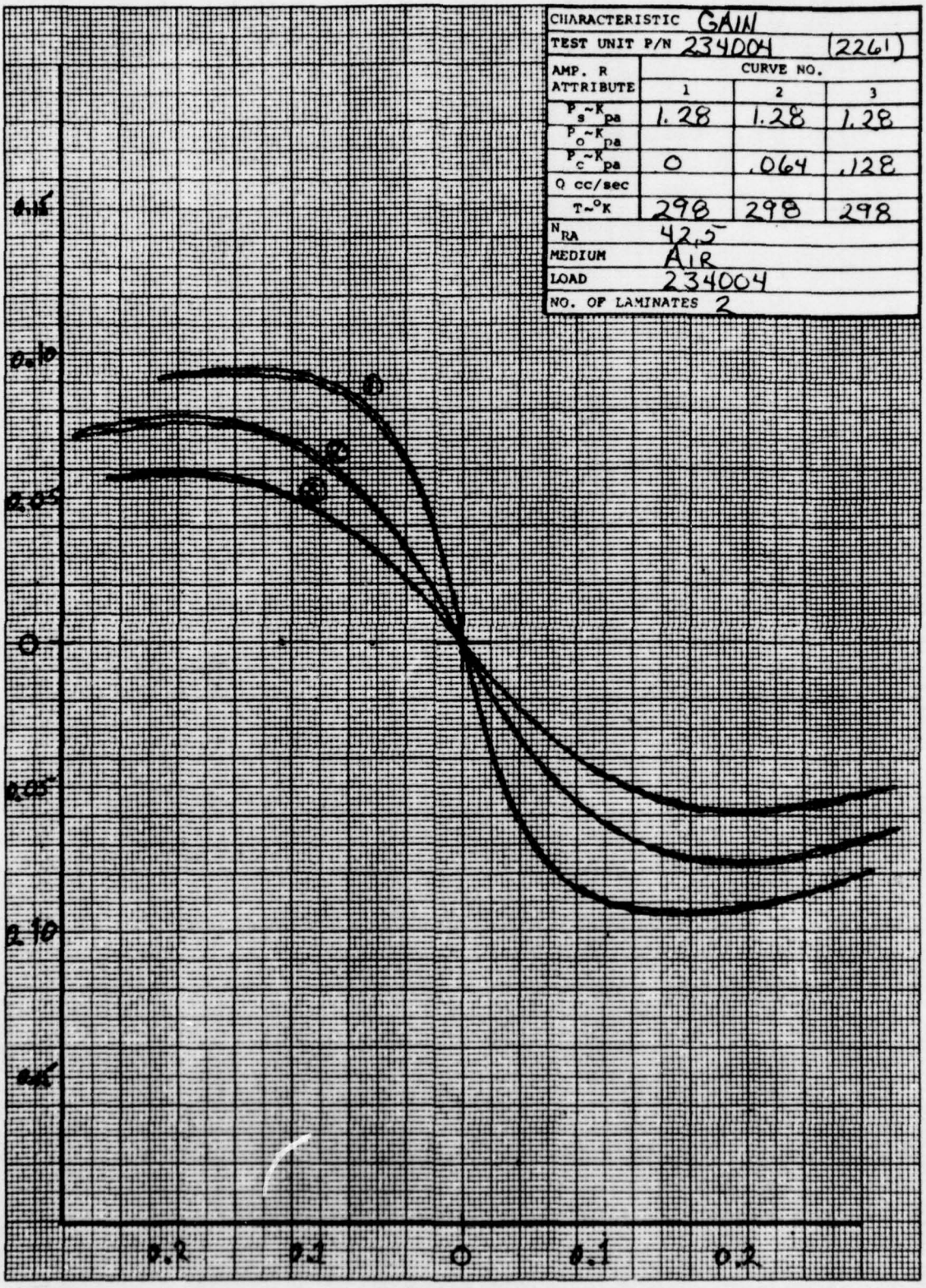

CHARACTERISTIC GAIN
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~$K_{pa}$ 7.95 7.95 7.95
$P_o$~$K_{pa}$
$P_c$~$K_{pa}$ 0 .397 .795
Q cc/sec
T~°K 353 353 353
$N_{RA}$ 95
MEDIUM AIR
LOAD 234004
NO. OF LAMINATES 2
2.5
2.0
1.0
0
1.0
2.0
2.5
1.0
0.5
0
0.5
1.0
$\Delta P_o$, kPa
$\Delta P_{CD}$, kPa

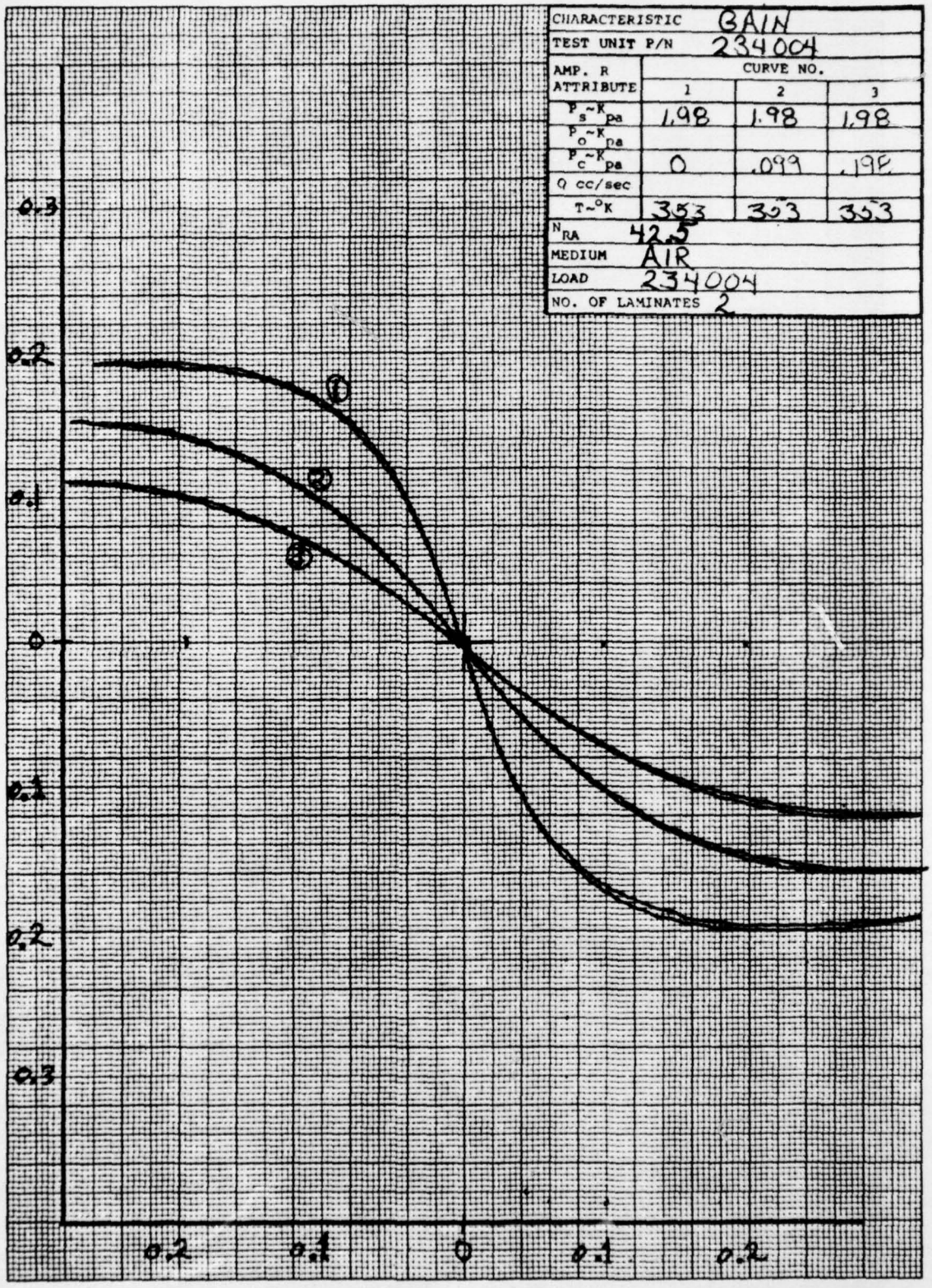

CHARACTERISTIC GAIN
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa 11.3 11.3 11.3
$P_o$~K pa
$P_c$~K pa 0 .56 1.13
Q cc/sec
T~°K 408 408 408
$N_{RA}$ 85
MEDIUM AIR
LOAD 234004
NO. OF LAMINATES 2
2.5
2.0
1.0
0
1.0
2.0
2.5
1.0
0.5
0
0.5
1.0
ΔPo, kPa
ΔPcD, kPa

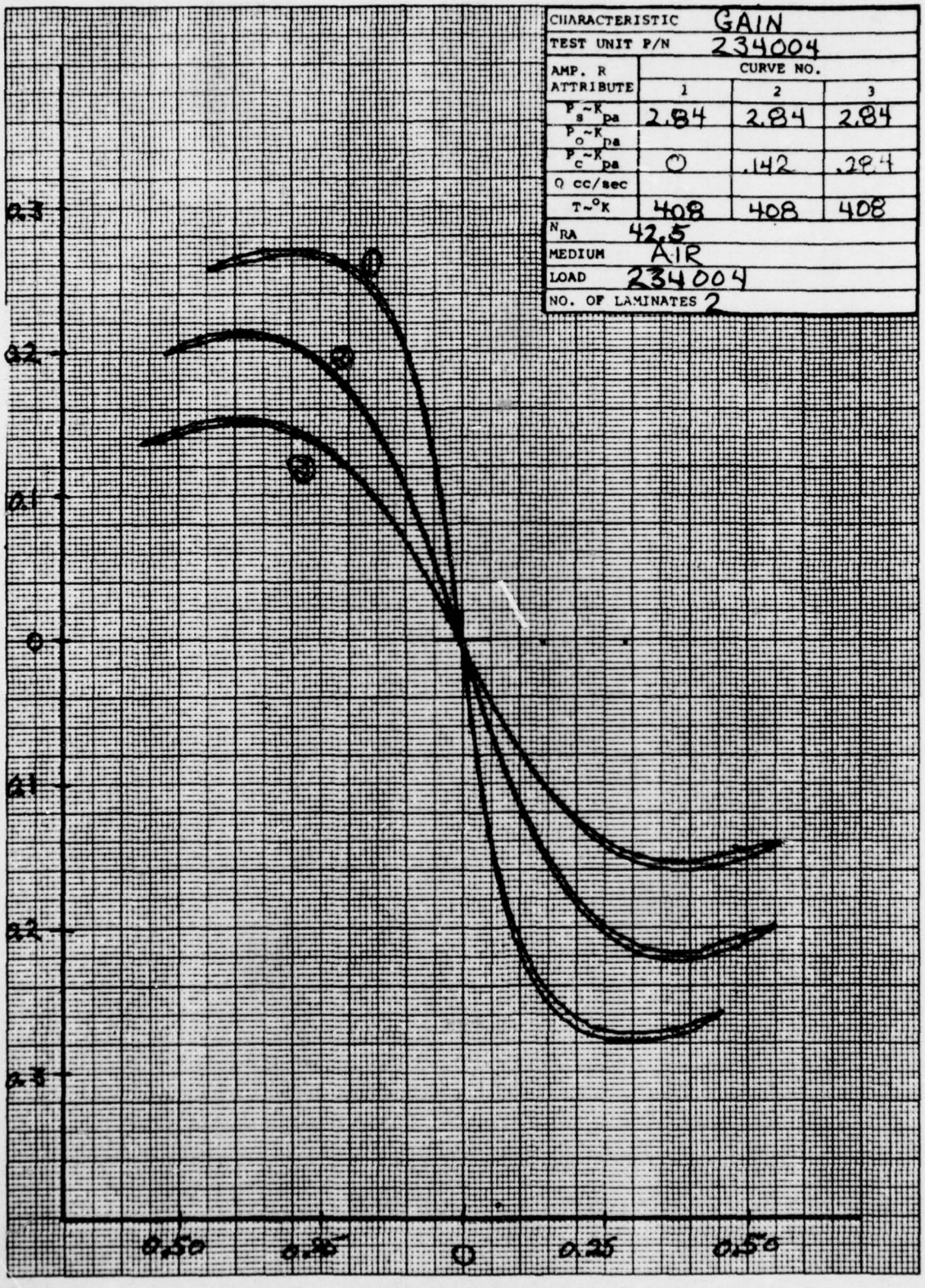

CHARACTERISTIC GAIN
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa 1.28 1.28 1.28
$P_o$~K pa
$P_c$~K pa 0 .064 .128
Q cc/sec
T~°K 298 298 298
$N_{RA}$ 42.5
MEDIUM Air
LOAD ∞
NO. OF LAMINATES 2
0.3
0.2
0.1
0
0.1
0.2
0.3
0.2
0.1
0
0.1
0.2
ΔPo, kPa
ΔPcp, kPa

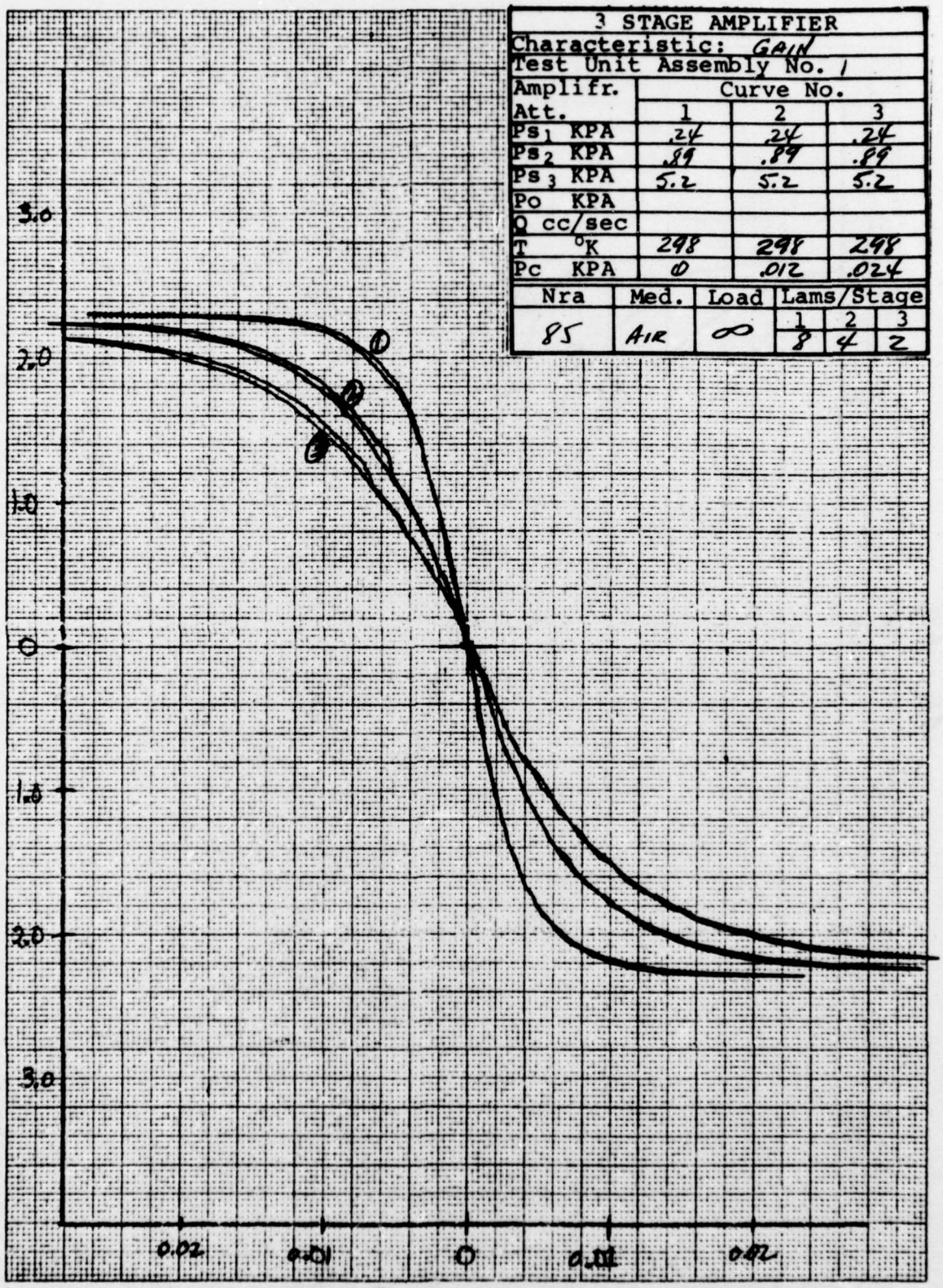

CHARACTERISTIC GAIN
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~Kpa 1.98 1.98 1.98
$P_o$~Kpa
$P_c$~Kpa 0 .099 .198
Q cc/sec
T~°K 353 353 353
$N_{RA}$ 42.5
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
0.4
0.3
0.2
0.1
0
0.1
0.2
0.3
0.4
0.2
0.1
0
0.1
0.2
ΔPo, kPa
ΔPCD, kPa


CHARACTERISTIC GAIN
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1 2 3
$P_s$~K pa 2.84 2.84 2.84
$P_o$~K pa
$P_c$~K pa 0 .142 .284
Q cc/sec
T~°K 408 408 408
$N_{RA}$ 42.0
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
0.75
0.50
0.25
0
0.25
0.50
0.75
0.50
0.25
0
0.25
0.50
$\Delta P_o$, kPa
$\Delta P_{CD}$, kPa


CHARACTERISTIC GAIN
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa 1.28 1.28 1.28
$P_o$~K pa
$P_c$~K pa 0 .064 .128
Q cc/sec
T~°K 298 298 298
$N_{RA}$ 42.5
MEDIUM AIR
LOAD 234004
NO. OF LAMINATES 2
0.15
0.10
0.05
0
0.05
0.10
0.2
0.1
0
0.1
0.2
$\Delta P_o$, kPa
$\Delta P_{CD}$, kPa

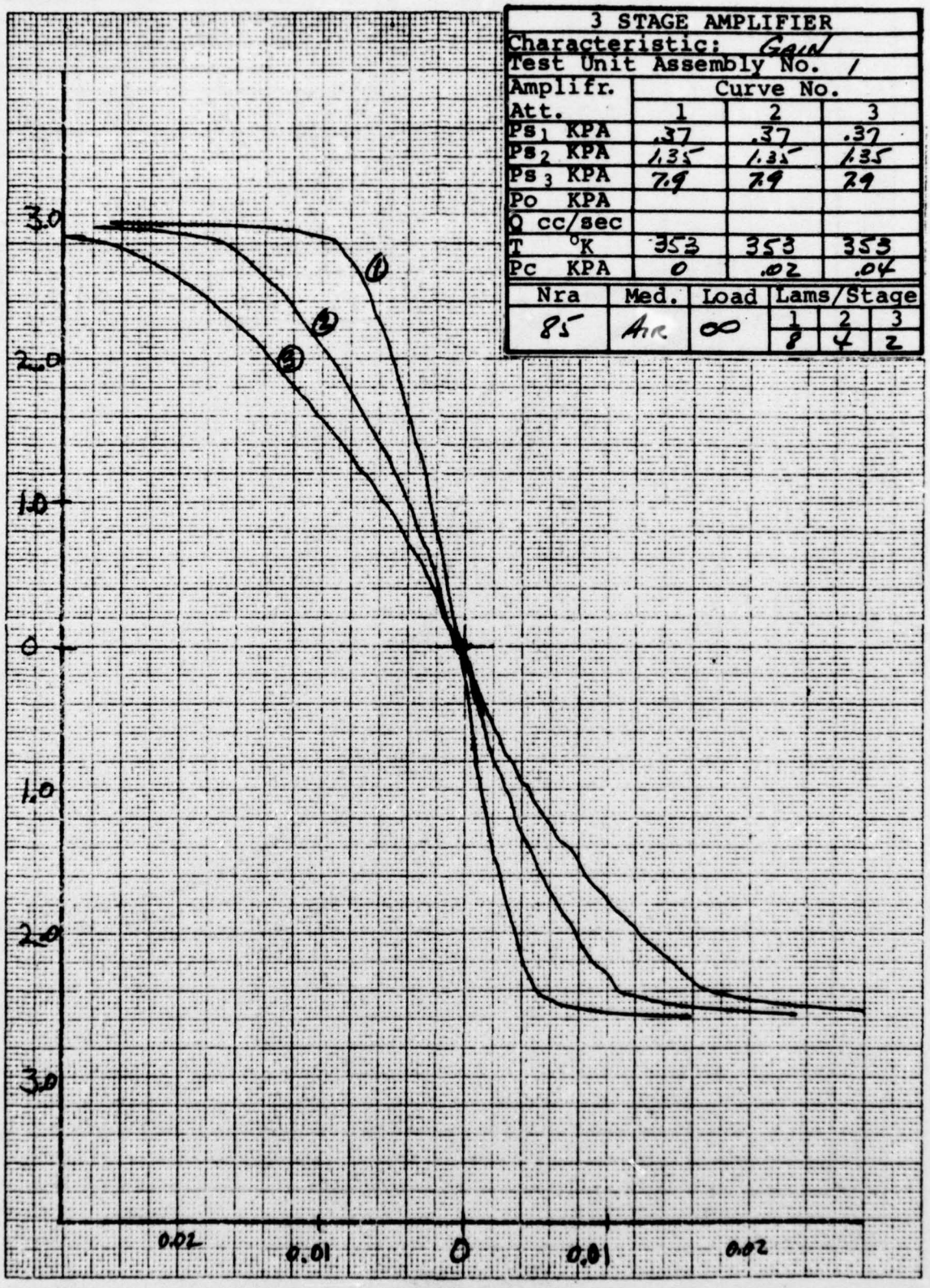

CHARACTERISTIC BAIN
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~$K_{pa}$ 1.98 1.98 1.98
$P_o$~$K_{pa}$
$P_c$~$K_{pa}$ 0 .099 .195
Q cc/sec
T~°K 353 353 353
$N_{RA}$ 42.5
MEDIUM AIR
LOAD 234004
NO. OF LAMINATES 2
0.3
0.2
0.1
0
0.1
0.2
0.3
0.2
0.1
0
0.1
0.2
ΔPo, kPa
ΔPcv, kPa


CHARACTERISTIC GAIN
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K$_{pa}$ 2.84 2.84 2.84
$P_o$~K$_{pa}$
$P_c$~K$_{pa}$ 0 .142 .284
Q cc/sec
T~°K 408 408 408
$N_{RA}$ 42.5
MEDIUM AIR
LOAD 234004
NO. OF LAMINATES 2
0.3
0.2
0.1
0
0.1
0.2
0.3
0.50
0.25
0.25
0.50
ΔPo, kPa
ΔPcD, kPa



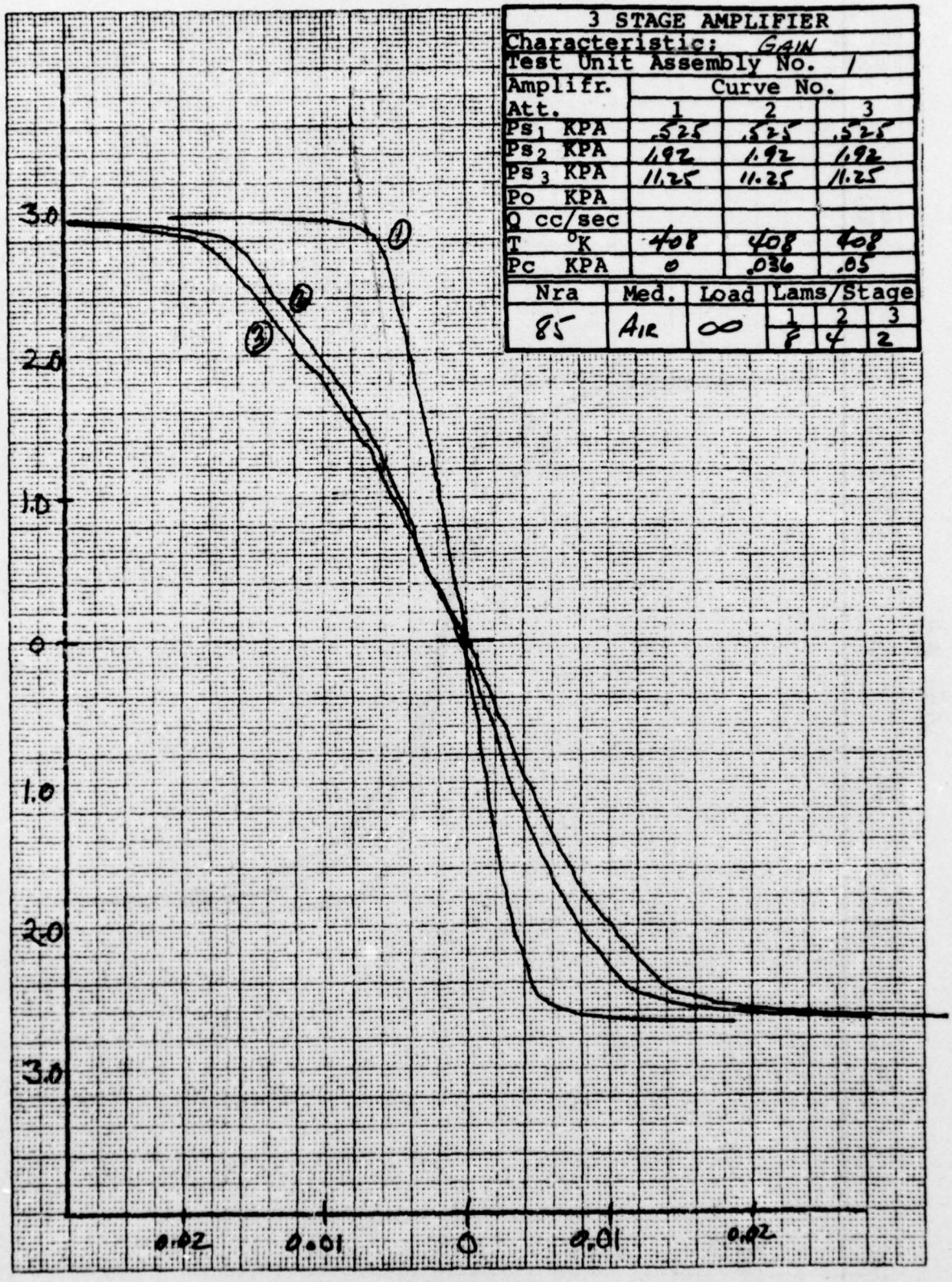

| 3 STAGE AMPLIFIER | | | |
|---|---|---|---|
| Characteristic: GAIN | | | |
| Test Unit Assembly No. 1 | | | |
| Amplifr. Att. | Curve No. 1 | Curve No. 2 | Curve No. 3 |
| $Ps_1$ KPA | .24 | .24 | .24 |
| $Ps_2$ KPA | .89 | .89 | .89 |
| $Ps_3$ KPA | 5.2 | 5.2 | 5.2 |
| Po KPA | | | |
| Q cc/sec | | | |
| T °K | 298 | 298 | 298 |
| Pc KPA | 0 | .012 | .024 |

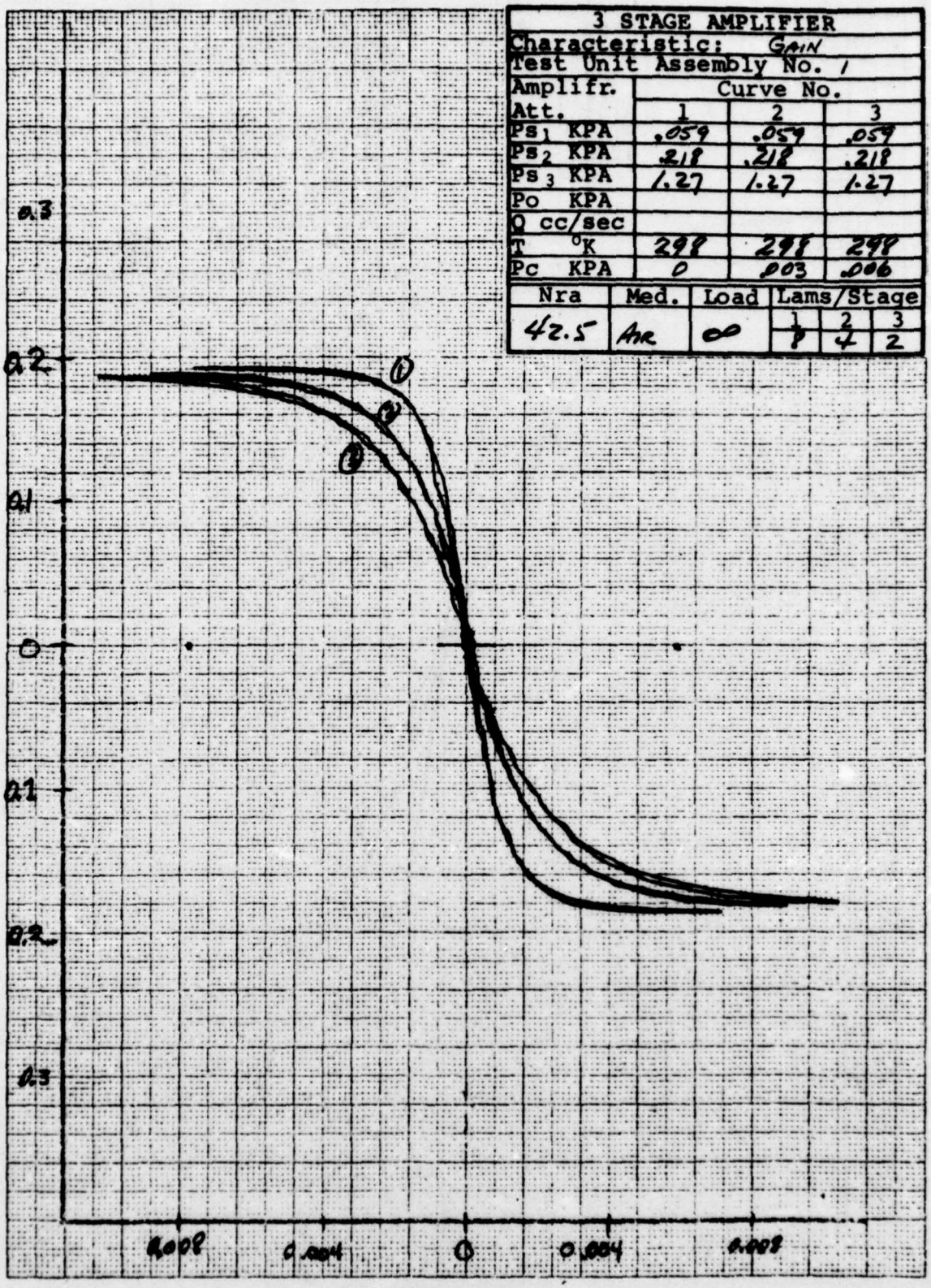
| Nra | Med. | Load | Lams/Stage 1 | 2 | 3 |
|---|---|---|---|---|---|
| 85 | AIR | ∞ | 8 | 4 | 2 |

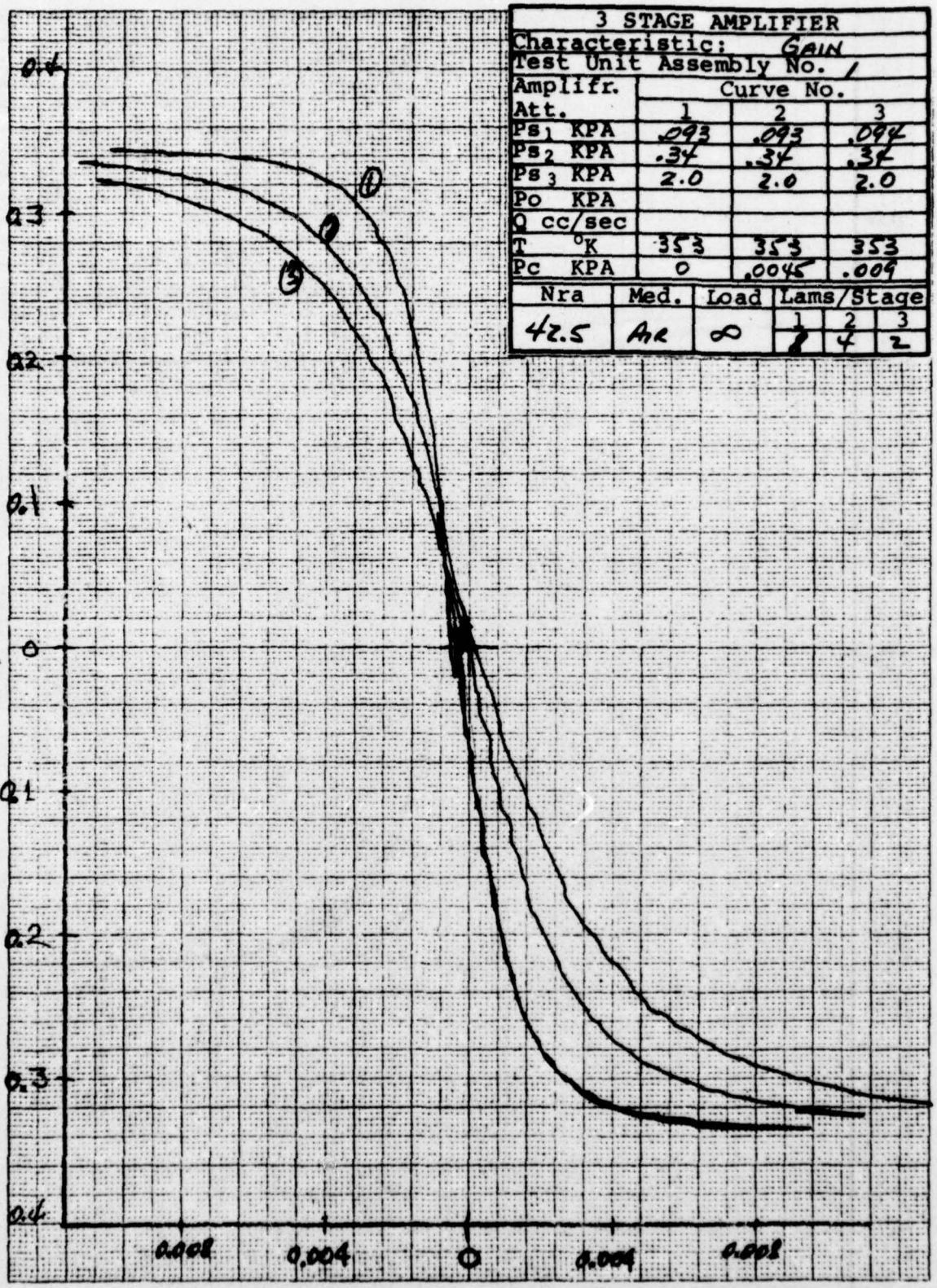


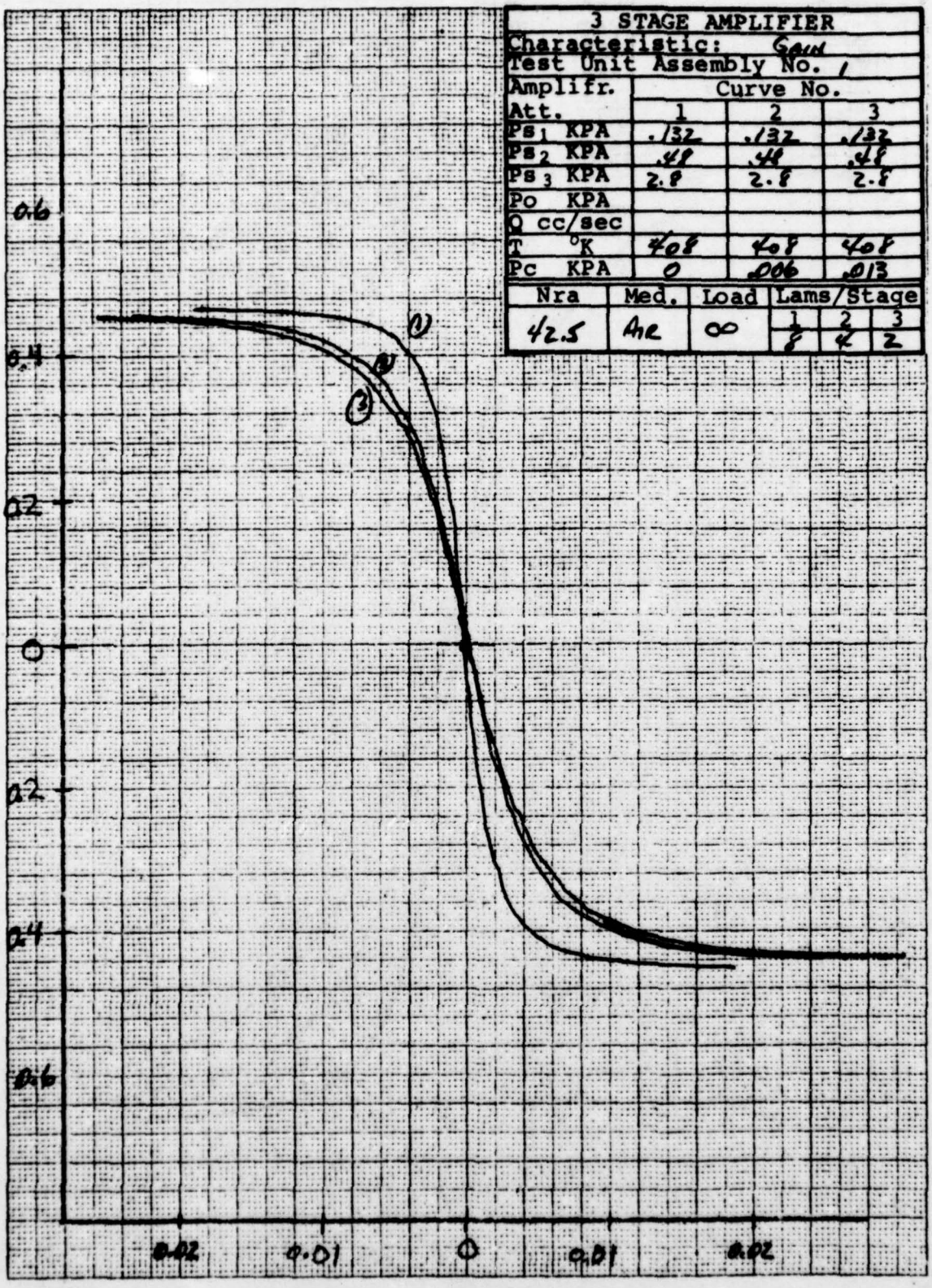

| 3 STAGE AMPLIFIER | | | |
|---|---|---|---|
| Characteristic: Gain | | | |
| Test Unit Assembly No. 1 | | | |
| Amplifr. Att. | Curve No. 1 | Curve No. 2 | Curve No. 3 |
| $Ps_1$ KPA | .37 | .37 | .37 |
| $Ps_2$ KPA | 1.35 | 1.35 | 1.35 |
| $Ps_3$ KPA | 7.9 | 7.9 | 7.9 |
| Po KPA | | | |
| Q cc/sec | | | |
| T °K | 353 | 353 | 353 |
| Pc KPA | 0 | .02 | .04 |

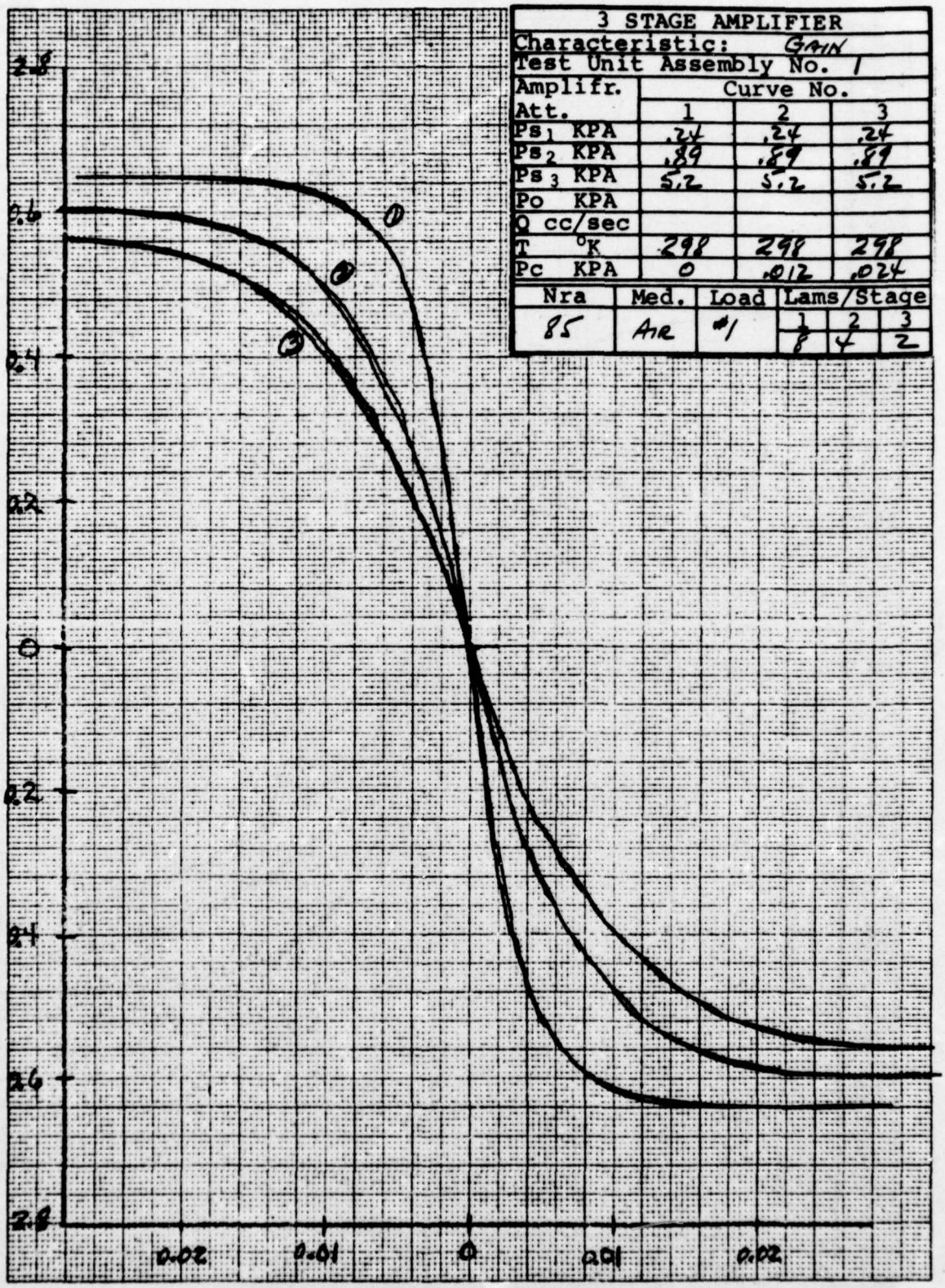
| Nra | Med. | Load | Lams/Stage 1 | 2 | 3 |
|---|---|---|---|---|---|
| 85 | Air | ∞ | 1/8 | 4 | 2 |

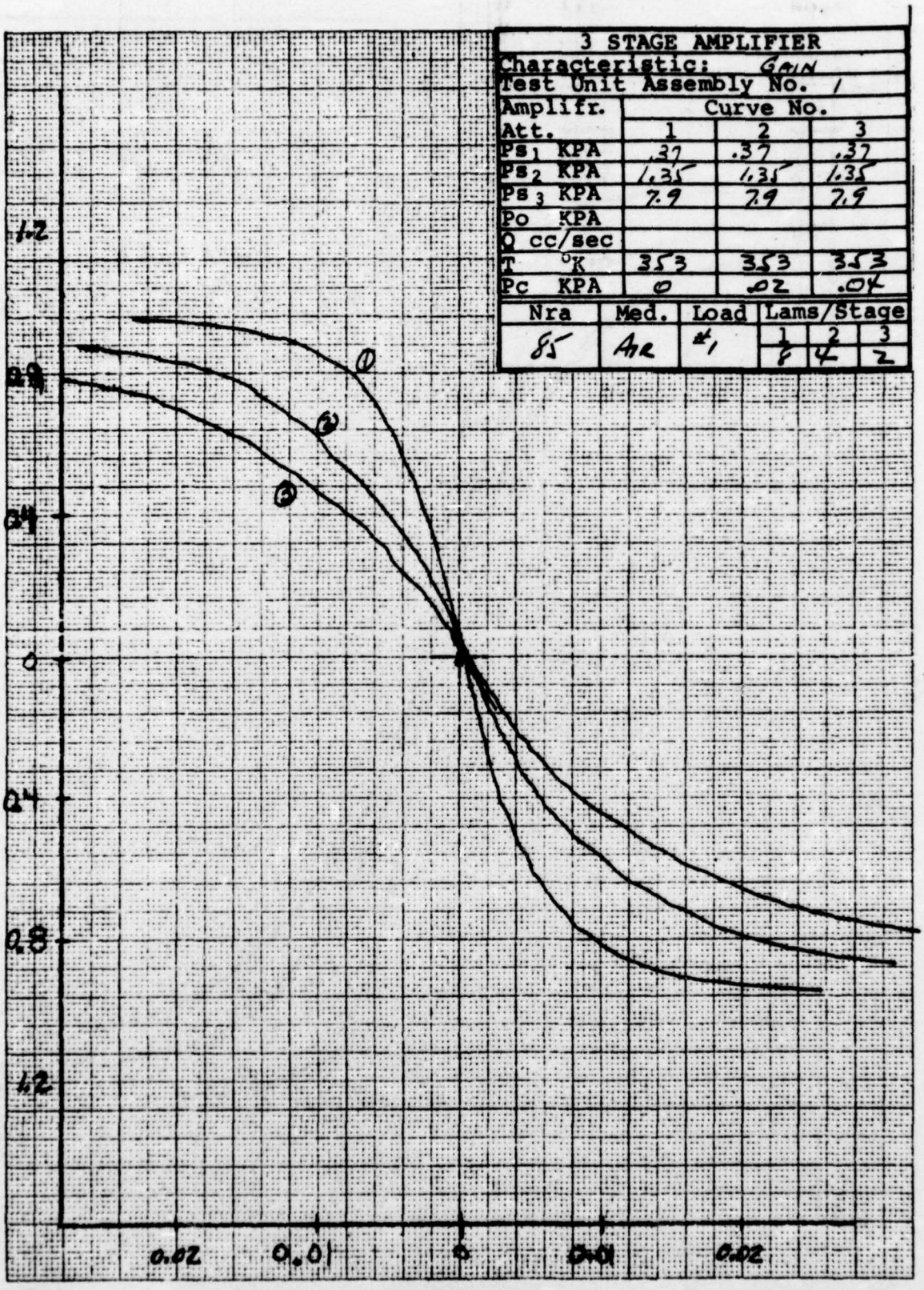

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 1
Amplifr. Att. | Curve No. 1 | 2 | 3
Ps1 KPA | .525 | .525 | .525
Ps2 KPA | 1.92 | 1.92 | 1.92
Ps3 KPA | 11.25 | 11.25 | 11.25
Po KPA | | |
Q cc/sec | | |
T °K | 408 | 408 | 408
Pc KPA | 0 | .036 | .05
Nra | Med. | Load | Lams/Stage 1 | 2 | 3
85 | Air | ∞ | 8 | 4 | 2
3.0
2.0
1.0
0
1.0
2.0
3.0
0.02
0.01
0
0.01
0.02
ΔPc, kPa
ΔPc, kPa

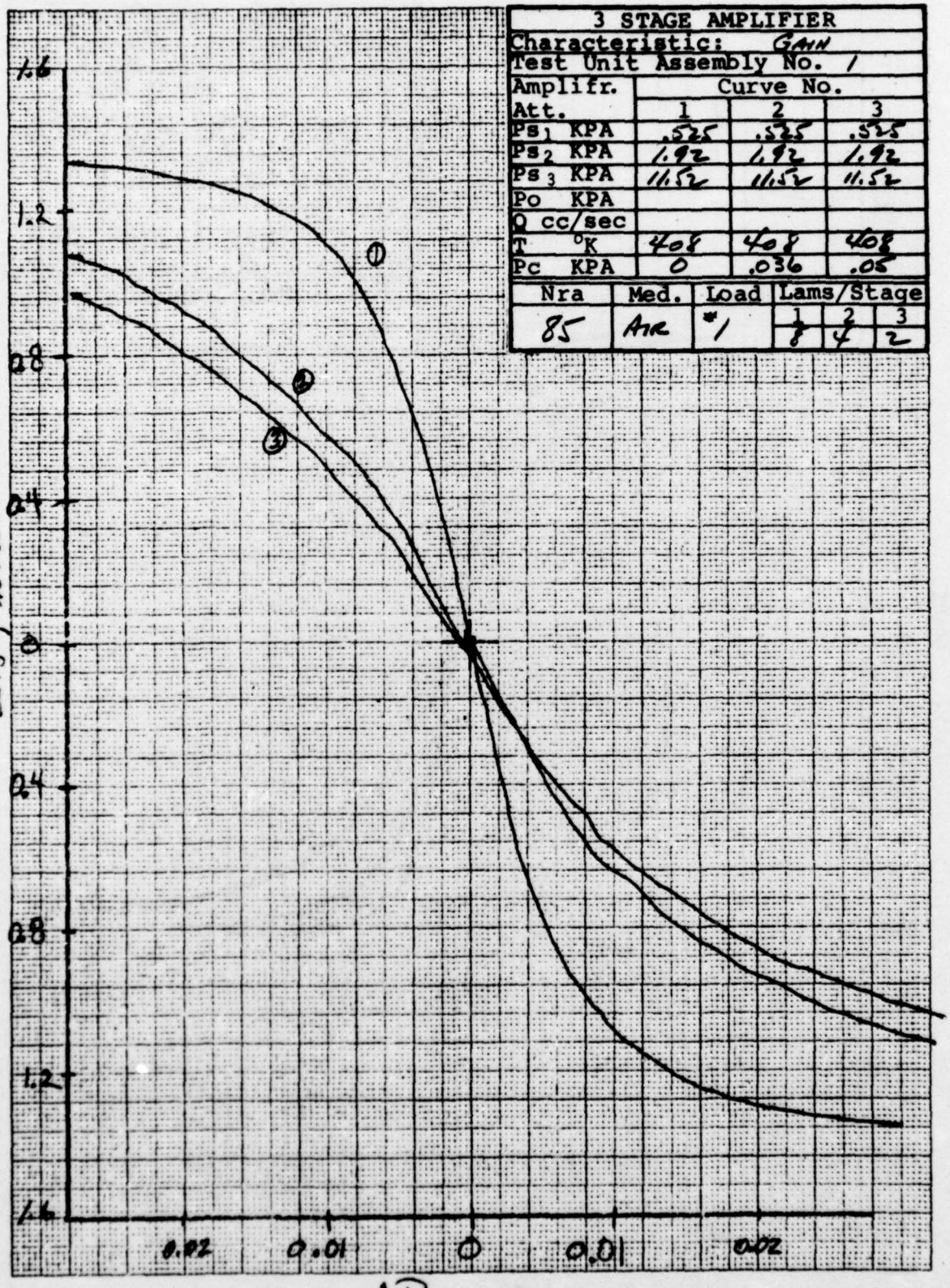

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 1
Amplifr. Att. | Curve No. 1 | 2 | 3
Ps1 KPA | .059 | .059 | .059
Ps2 KPA | .218 | .218 | .218
Ps3 KPA | 1.27 | 1.27 | 1.27
Po KPA | | |
Q cc/sec | | |
T °K | 298 | 298 | 298
Pc KPA | 0 | .003 | .006
Nra | Med. | Load | Lams/Stage 1 | 2 | 3
42.5 | Air | ∞ | 1 | 4 | 2
0.3
0.2
0.1
0
0.1
0.2
0.3
ΔPo, kPa
0.008
0.004
0
0.004
0.008
ΔPc, kPa

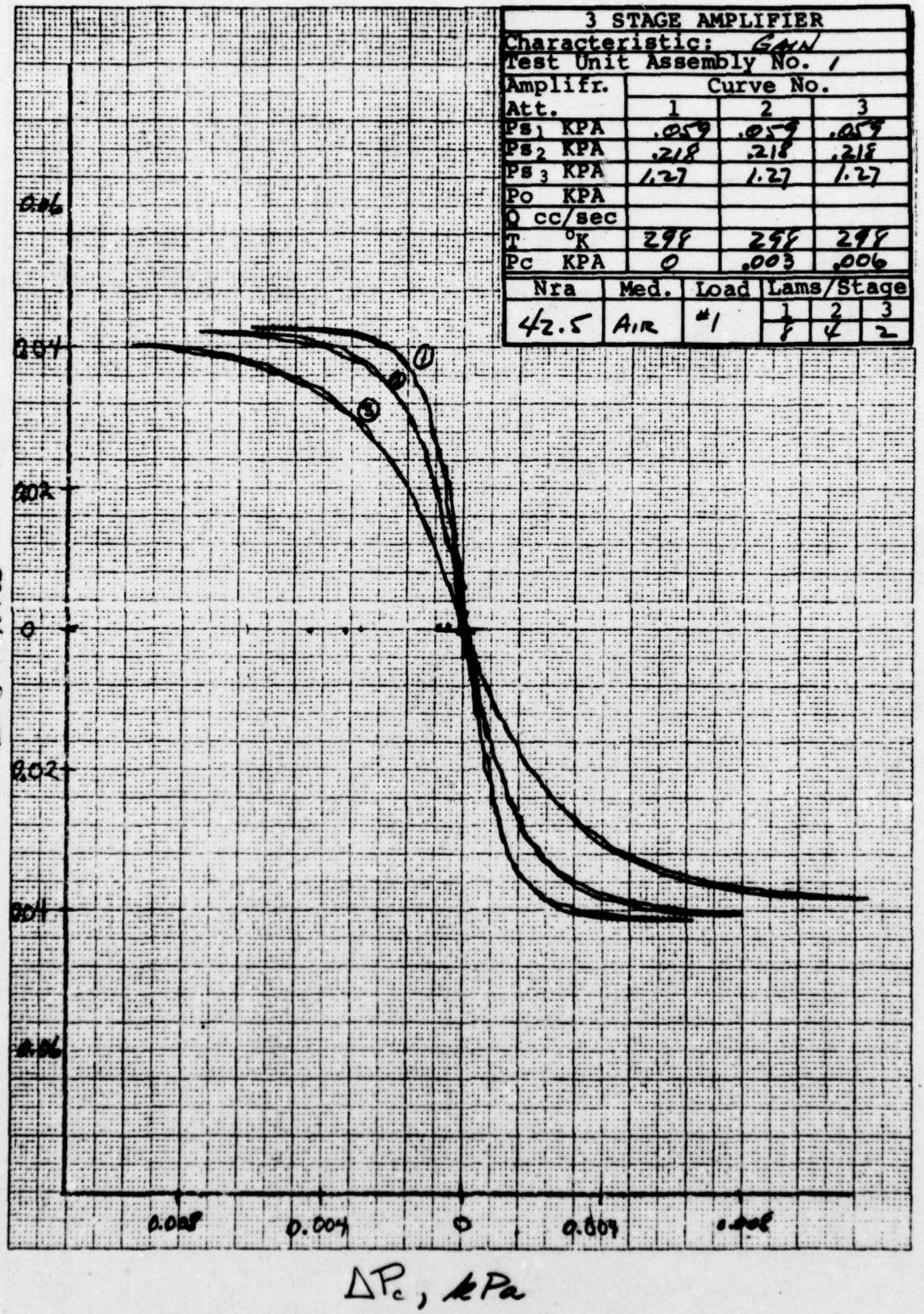

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 1
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .093 .093 .094
Ps2 KPA .34 .34 .34
Ps3 KPA 2.0 2.0 2.0
Po KPA
Q cc/sec
T °K 353 353 353
Pc KPA 0 .0045 .009
Nra Med. Load Lams/Stage 1 2 3
42.5 Air ∞ 8 4 2
0.4
0.3
0.2
0.1
0
0.1
0.2
0.3
0.4
ΔPo, kPa
0.008
0.004
0
0.004
0.008
ΔPc, kPa

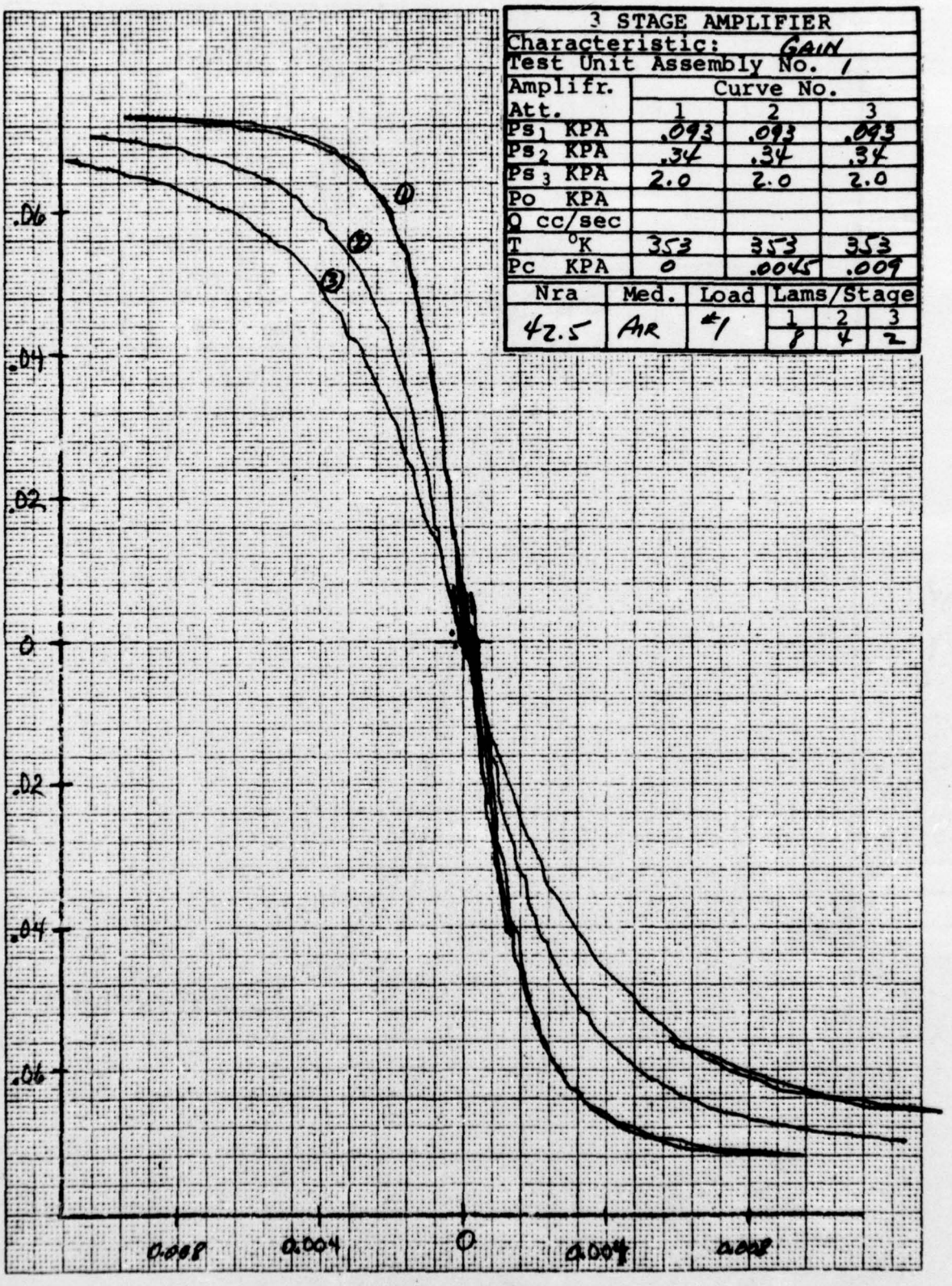

3 STAGE AMPLIFIER
Characteristic: Gain
Test Unit Assembly No. 1
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .132 .132 .132
Ps2 KPA .48 .48 .48
Ps3 KPA 2.8 2.8 2.8
Po KPA
Q cc/sec
T °K 408 408 408
Pc KPA 0 .006 .013
Nra 42.5
Med. Air
Load ∞
Lams/Stage 1 2 3 / 8 4 2
0.6
0.4
0.2
0
0.2
0.4
0.6
-0.02
-0.01
0
0.01
0.02
ΔPc, kPa

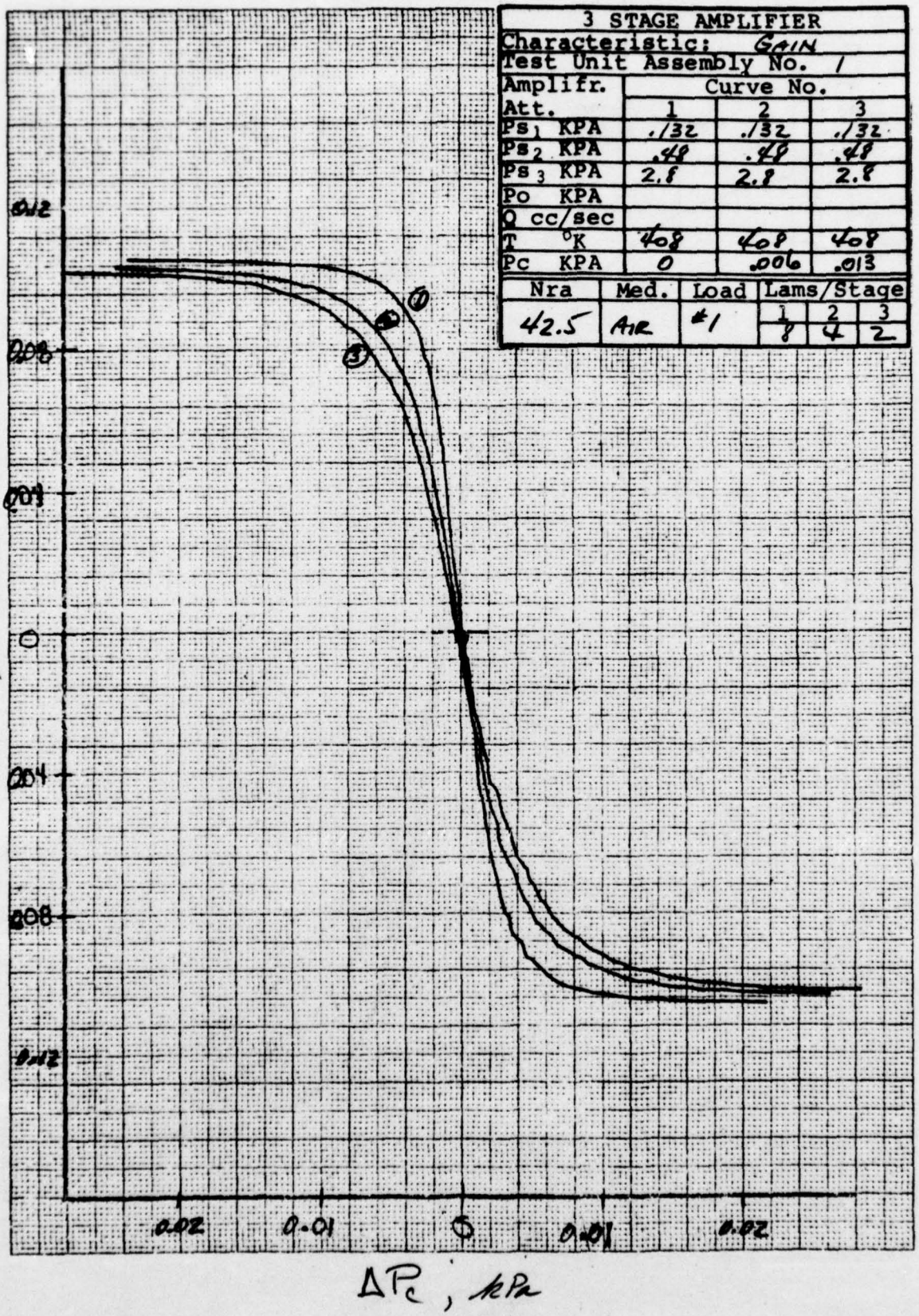

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 1
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .24 .24 .24
Ps2 KPA .89 .89 .89
Ps3 KPA 5.2 5.2 5.2
Po KPA
Q cc/sec
T °K 298 298 298
Pc KPA 0 .012 .024
Nra 85
Med. Air
Load #1
Lams/Stage 1/8 2/4 3/2
2.8
2.6
2.4
2.2
0
2.2
2.4
2.6
2.8
0.02
0.01
0
0.01
0.02
ΔPo, kPa
ΔPc, kPa

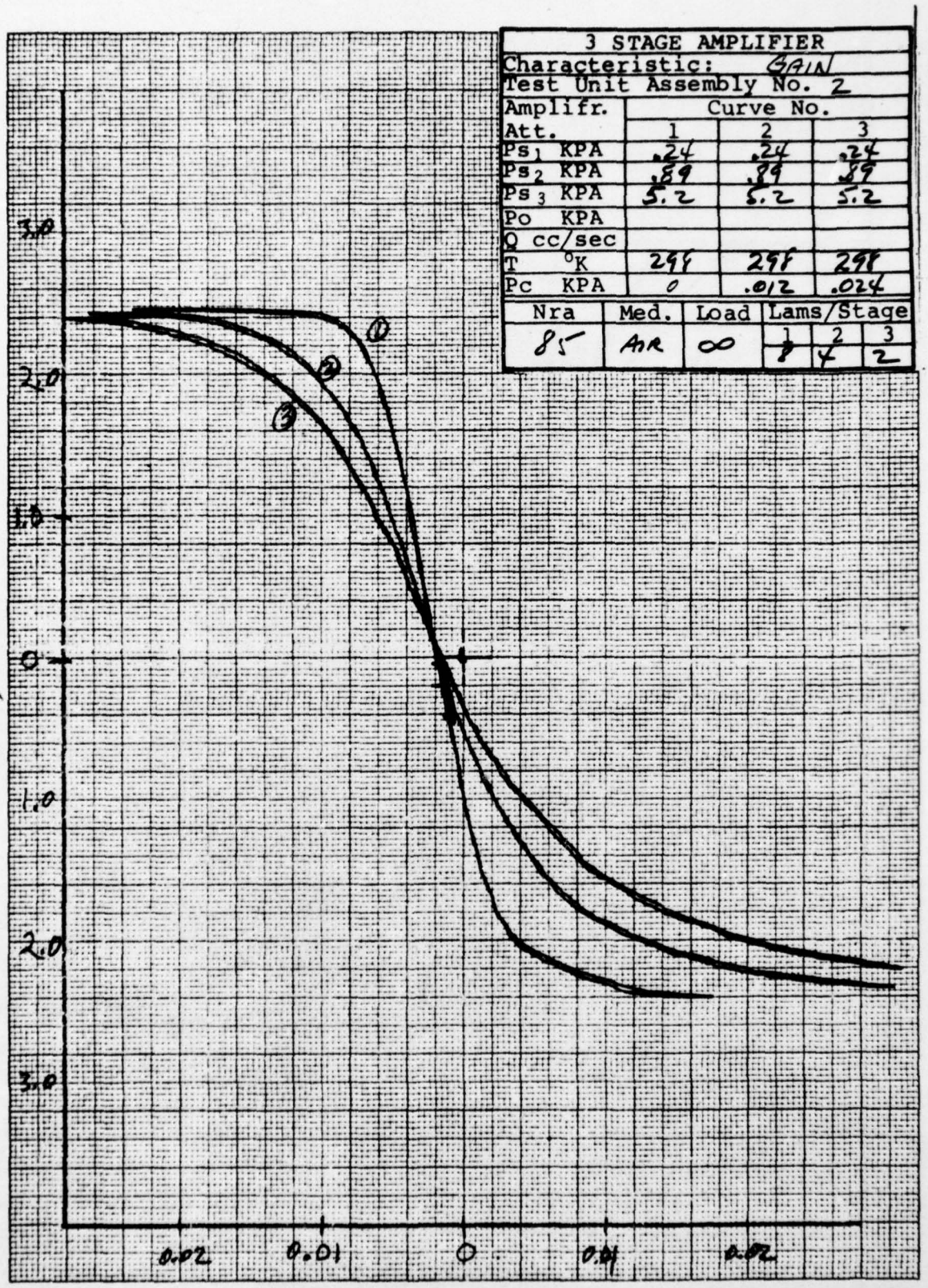

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 1
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .37 .37 .37
Ps2 KPA 1.35 1.35 1.35
Ps3 KPA 7.9 7.9 7.9
Po KPA
Q cc/sec
T °K 353 353 353
Pc KPA 0 .02 .04
Nra 85
Med. Air
Load #1
Lams/Stage 1/8 2/4 3/2
1.2
0.8
0.4
0
0.4
0.8
1.2
0.02
0.01
0
0.01
0.02
ΔPc, kPa
ΔPc, kPa

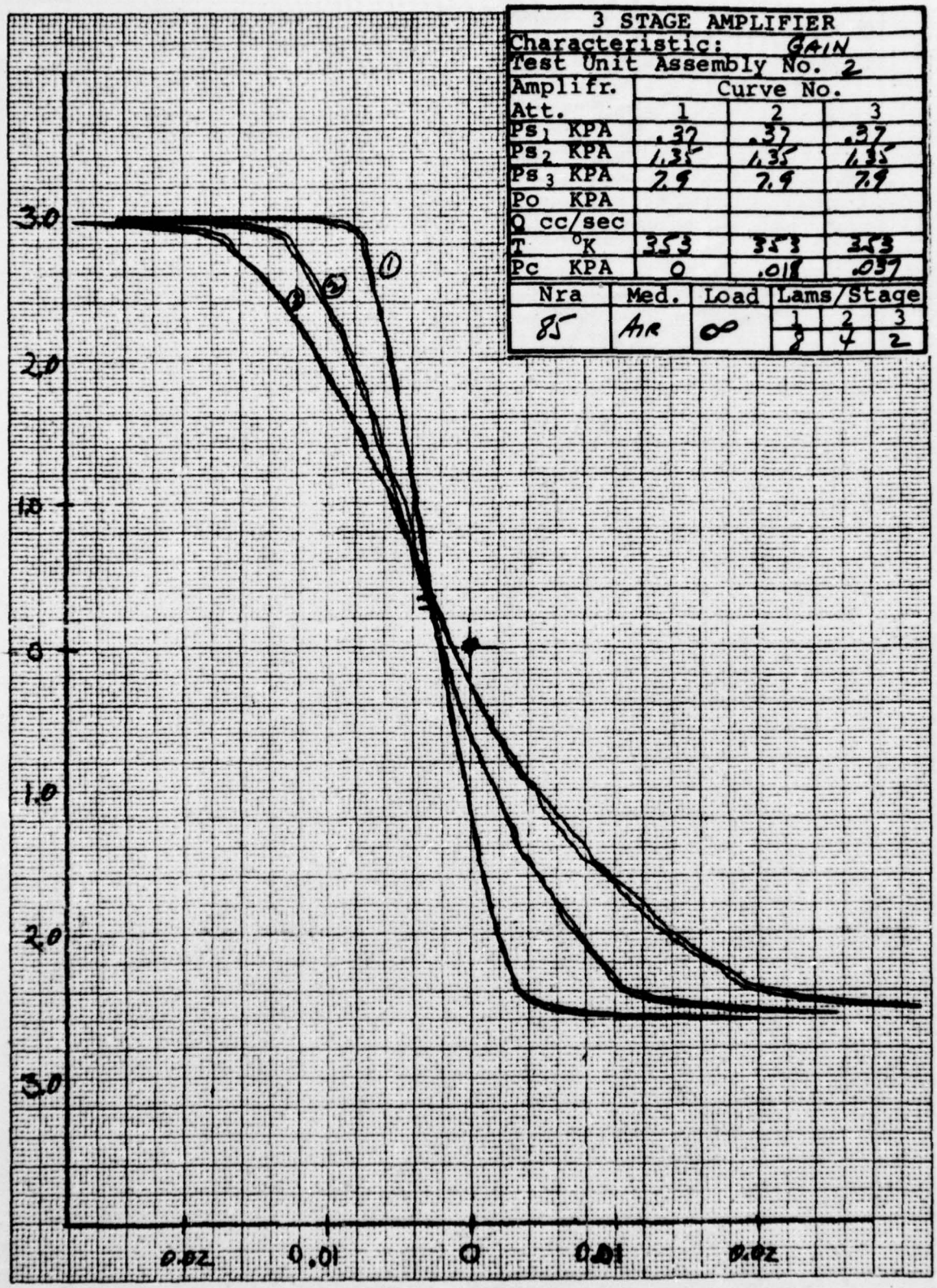

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 1
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .525 .525 .525
Ps2 KPA 1.92 1.92 1.92
Ps3 KPA 11.52 11.52 11.52
Po KPA
Q cc/sec
T °K 408 408 408
Pc KPA 0 .036 .05
Nra 85
Med. Air
Load #1
Lams/Stage 1 2 3 / 8 4 2
1.6
1.2
0.8
0.4
0
0.4
0.8
1.2
1.6
0.02
0.01
0
0.01
0.02
ΔPo, kPa
ΔPc, kPa
1
2
3

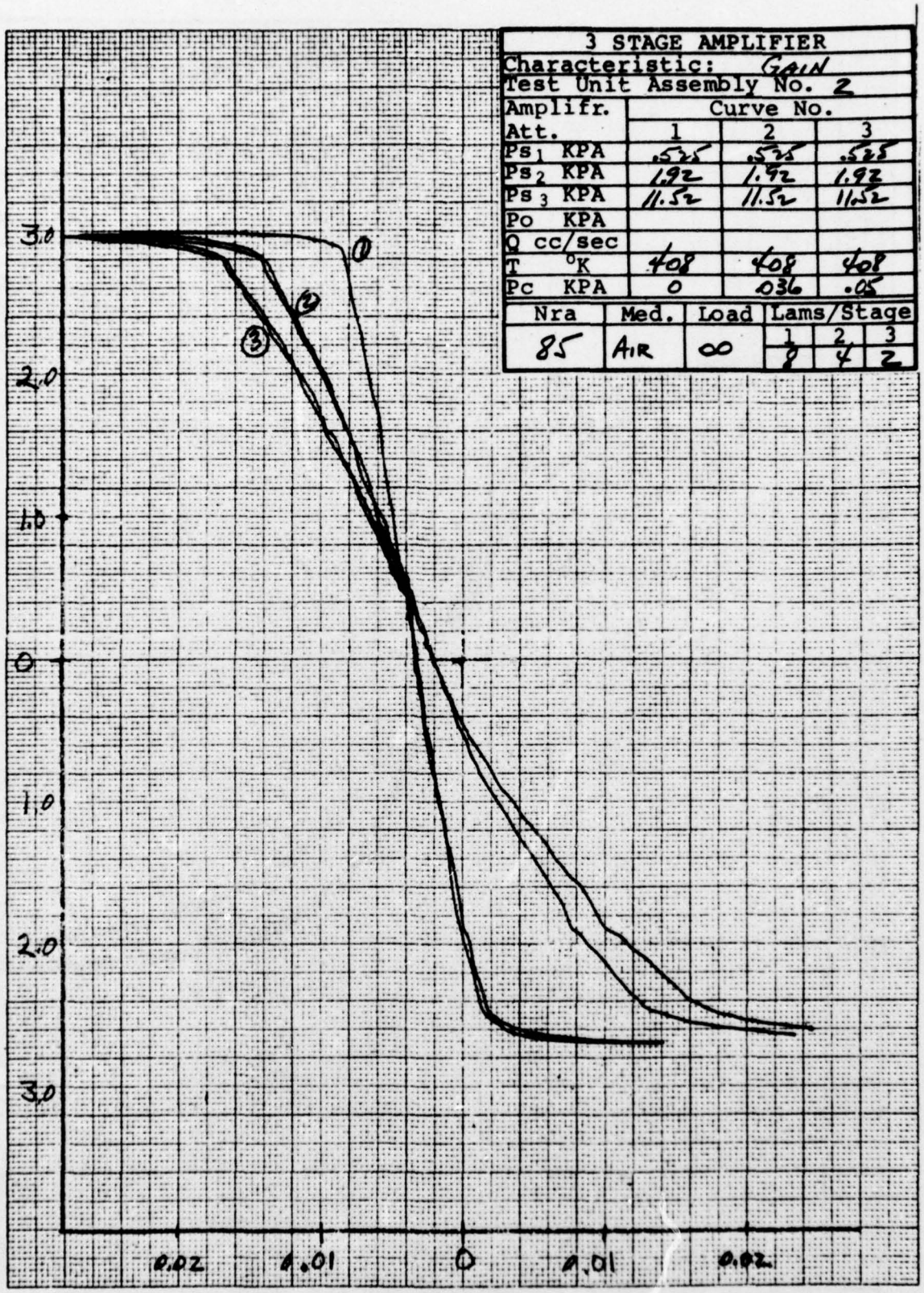

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 1
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .059 .059 .059
Ps2 KPA .218 .218 .218
Ps3 KPA 1.27 1.27 1.27
Po KPA
Q cc/sec
T °K 298 298 298
Pc KPA 0 .003 .006
Nra 42.5
Med. AIR
Load #1
Lams/Stage 1 2 3 / 5 4 2
0.006
0.004
0.002
0
0.002
0.004
0.006
ΔPo kPa
0.008
0.004
0
0.004
0.008
ΔPc, kPa

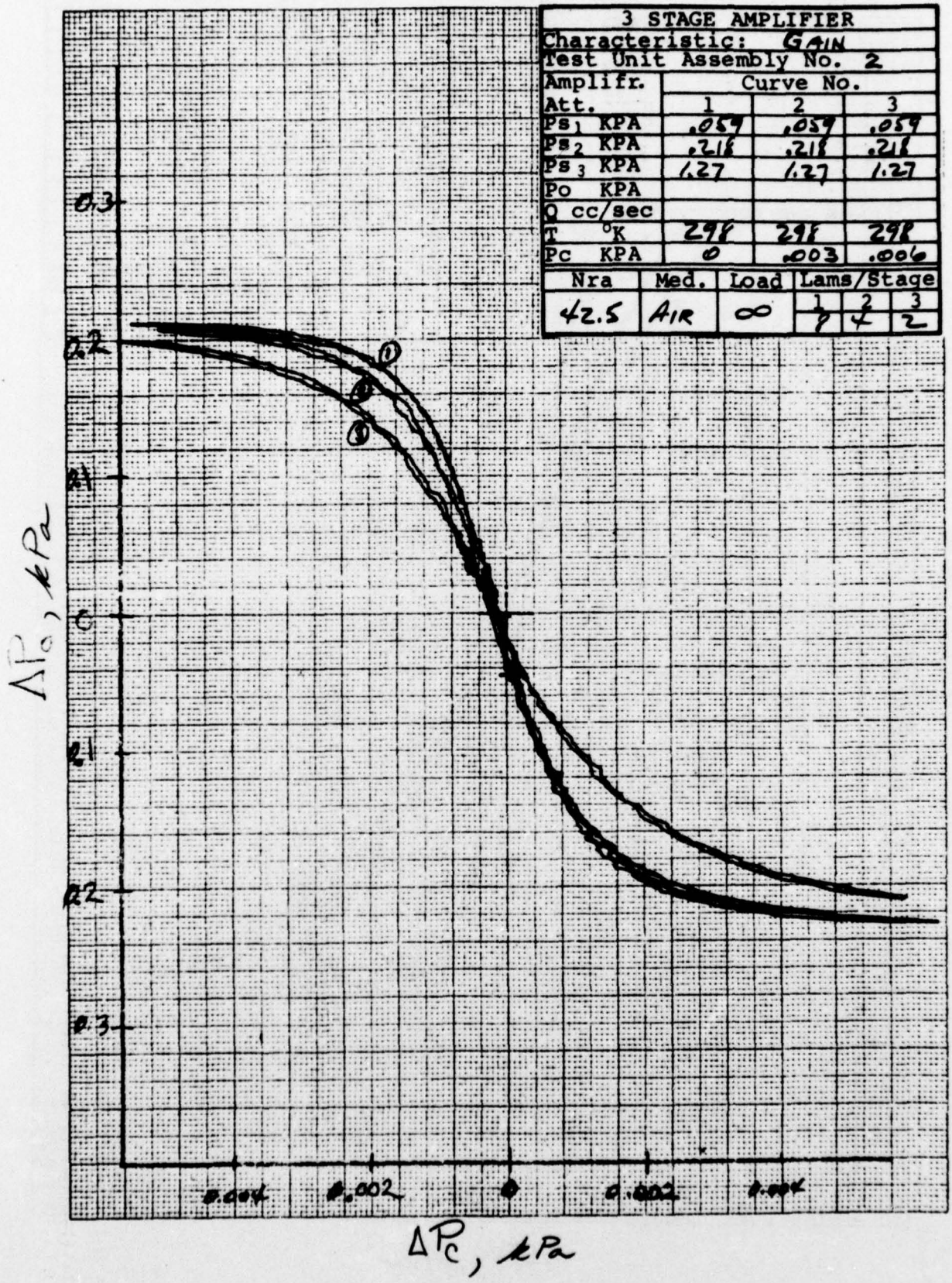

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 1
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .093 .093 .093
Ps2 KPA .34 .34 .34
Ps3 KPA 2.0 2.0 2.0
Po KPA
Q cc/sec
T °K 353 353 353
Pc KPA 0 .0045 .009
Nra 42.5
Med. AR
Load #1
Lams/Stage 1 8 2 4 3 2
.06
.04
.02
0
.02
.04
.06
0.008
0.004
0
0.004
0.008
ΔPc, kPa
ΔPo, kPa

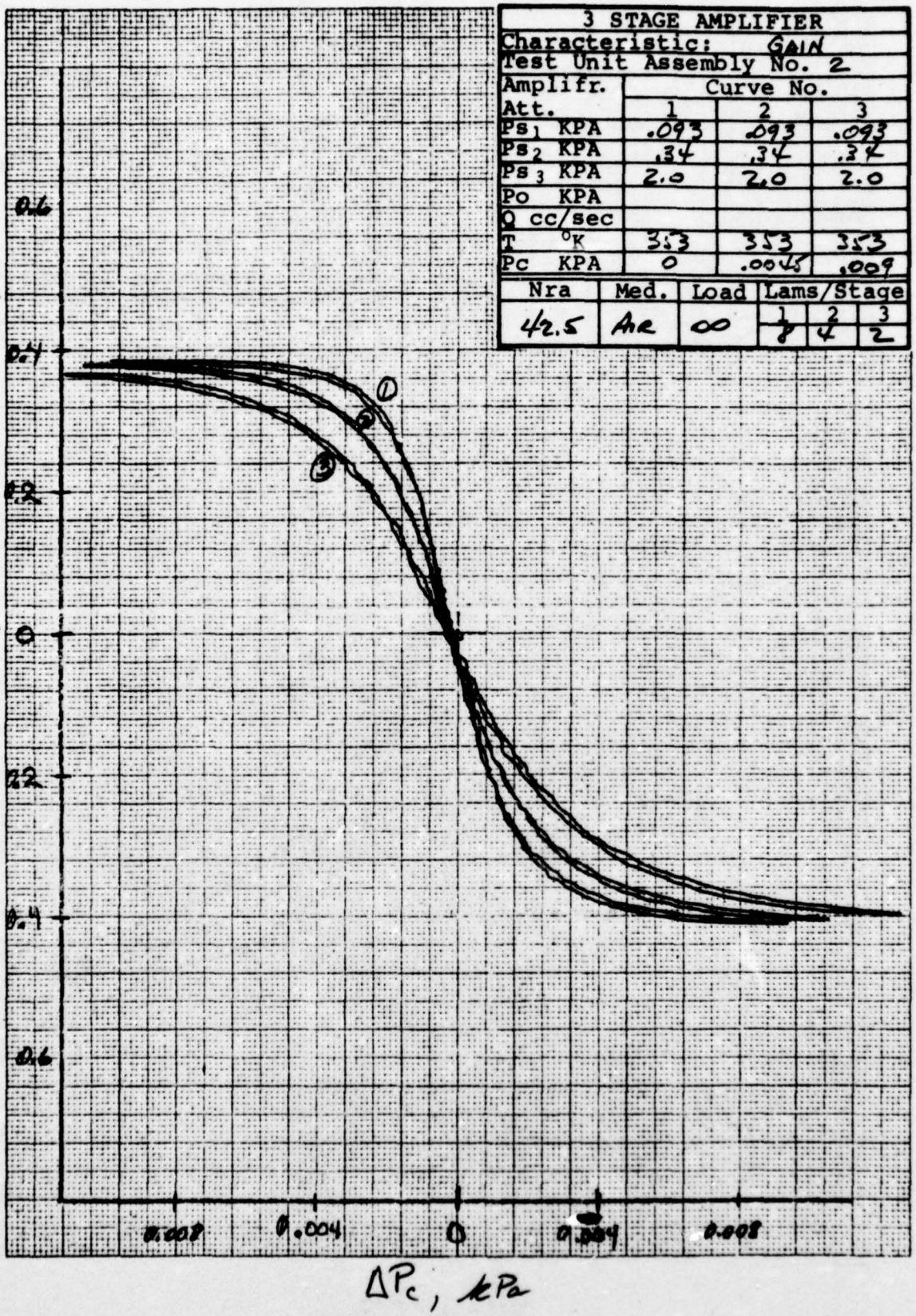

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 1
Amplifr. Att. | Curve No. 1 | 2 | 3
Ps1 KPA | .132 | .132 | .132
Ps2 KPA | .48 | .48 | .48
Ps3 KPA | 2.8 | 2.8 | 2.8
Po KPA | | |
Q cc/sec | | |
T °K | 408 | 408 | 408
Pc KPA | 0 | .006 | .013
Nra | Med. | Load | Lams/Stage 1/8 | 2/4 | 3/2
42.5 | Air | #1
0.012
0.008
0.004
0
0.004
0.008
0.012
0.02
0.01
0
0.01
0.02
ΔPb, kPa
ΔPc, kPa

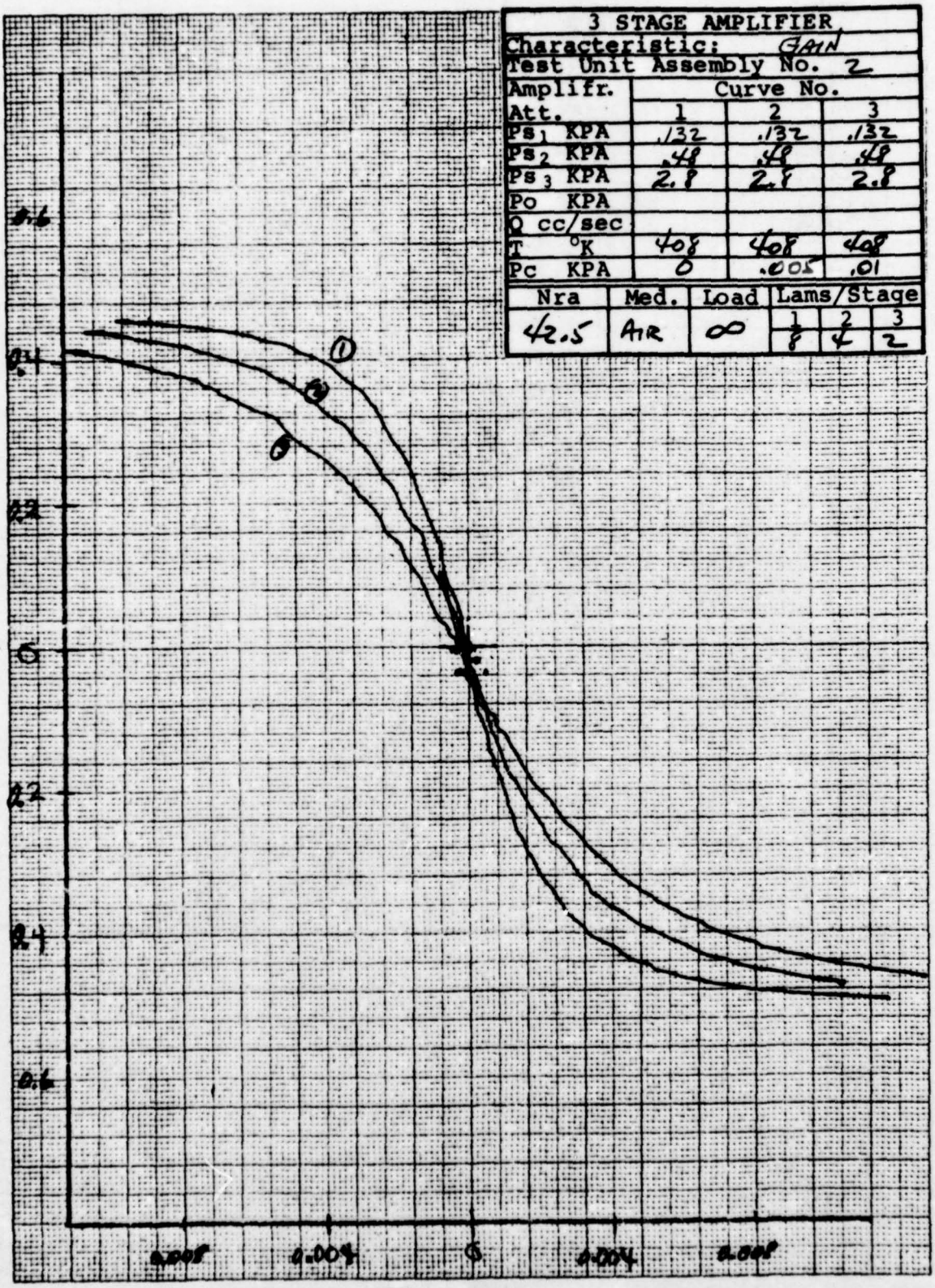

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 2
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .24 .24 .24
Ps2 KPA .89 .89 .89
Ps3 KPA 5.2 5.2 5.2
Po KPA
Q cc/sec
T °K 298 298 298
Pc KPA 0 .012 .024
Nra 85
Med. AIR
Load ∞
Lams/Stage 1 2 3
1 4 2
3.0
2.0
1.0
0
1.0
2.0
3.0
0.02
0.01
0
0.01
0.02
ΔPo, kPa
ΔPc, kPa

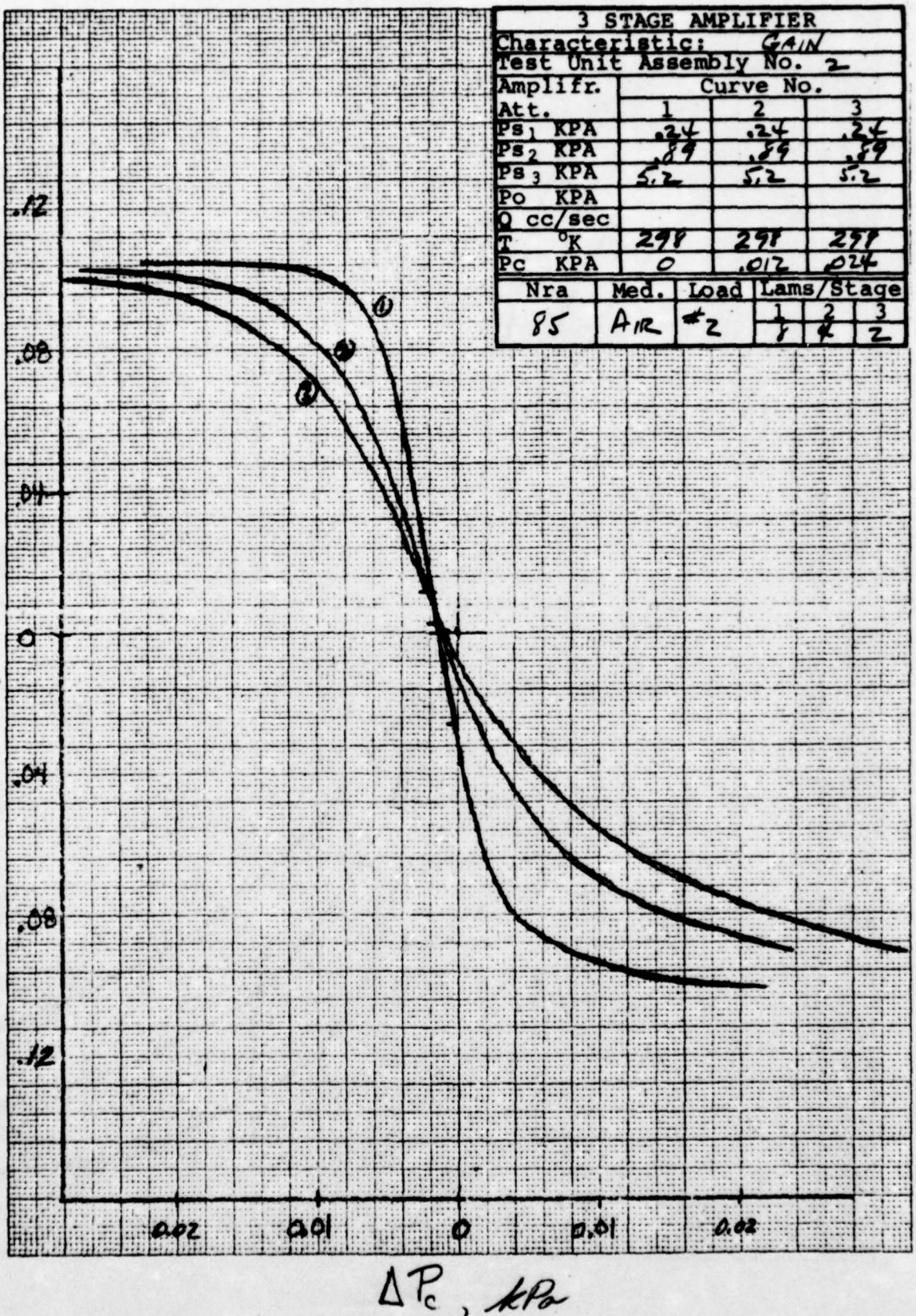

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 2
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .37 .37 .37
Ps2 KPA 1.35 1.35 1.35
Ps3 KPA 7.9 7.9 7.9
Po KPA
Q cc/sec
T °K 353 353 353
Pc KPA 0 .018 .037
Nra 85
Med. Air
Load ∞
Lams/Stage 1/8 2/4 3/2
3.0
2.0
1.0
0
1.0
2.0
3.0
0.02
0.01
0
0.01
0.02
ΔPo, kPa
ΔPc, kPa

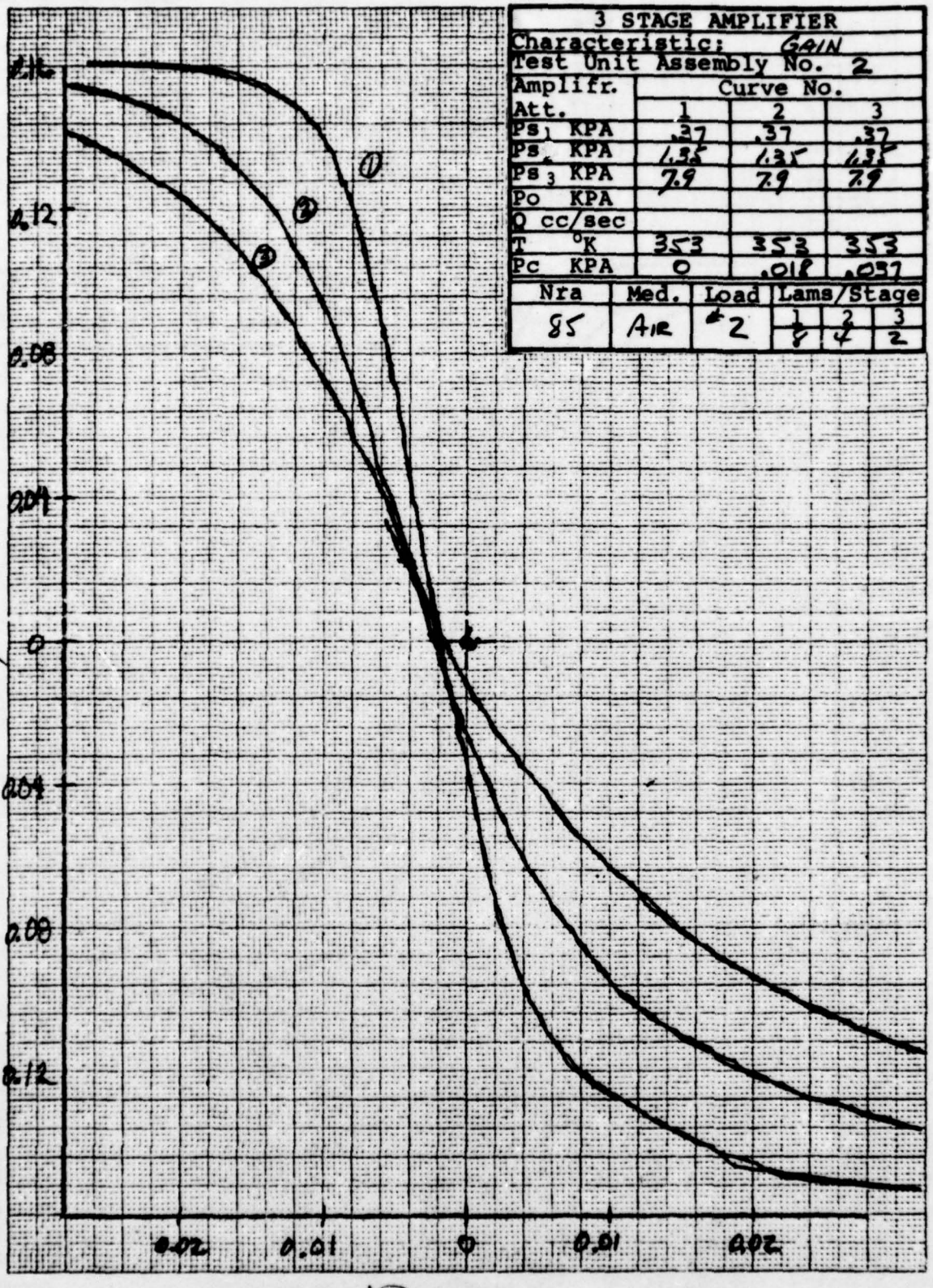

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 2
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .525 .525 .525
Ps2 KPA 1.92 1.92 1.92
Ps3 KPA 11.52 11.52 11.52
Po KPA
Q cc/sec
T °K 408 408 408
Pc KPA 0 .036 .05
Nra 85
Med. AIR
Load ∞
Lams/Stage 1 2 3 1/8 4 2
3.0
2.0
1.0
0
1.0
2.0
3.0
0.02
0.01
0
0.01
0.02
ΔPo, kPa
ΔPc, kPa

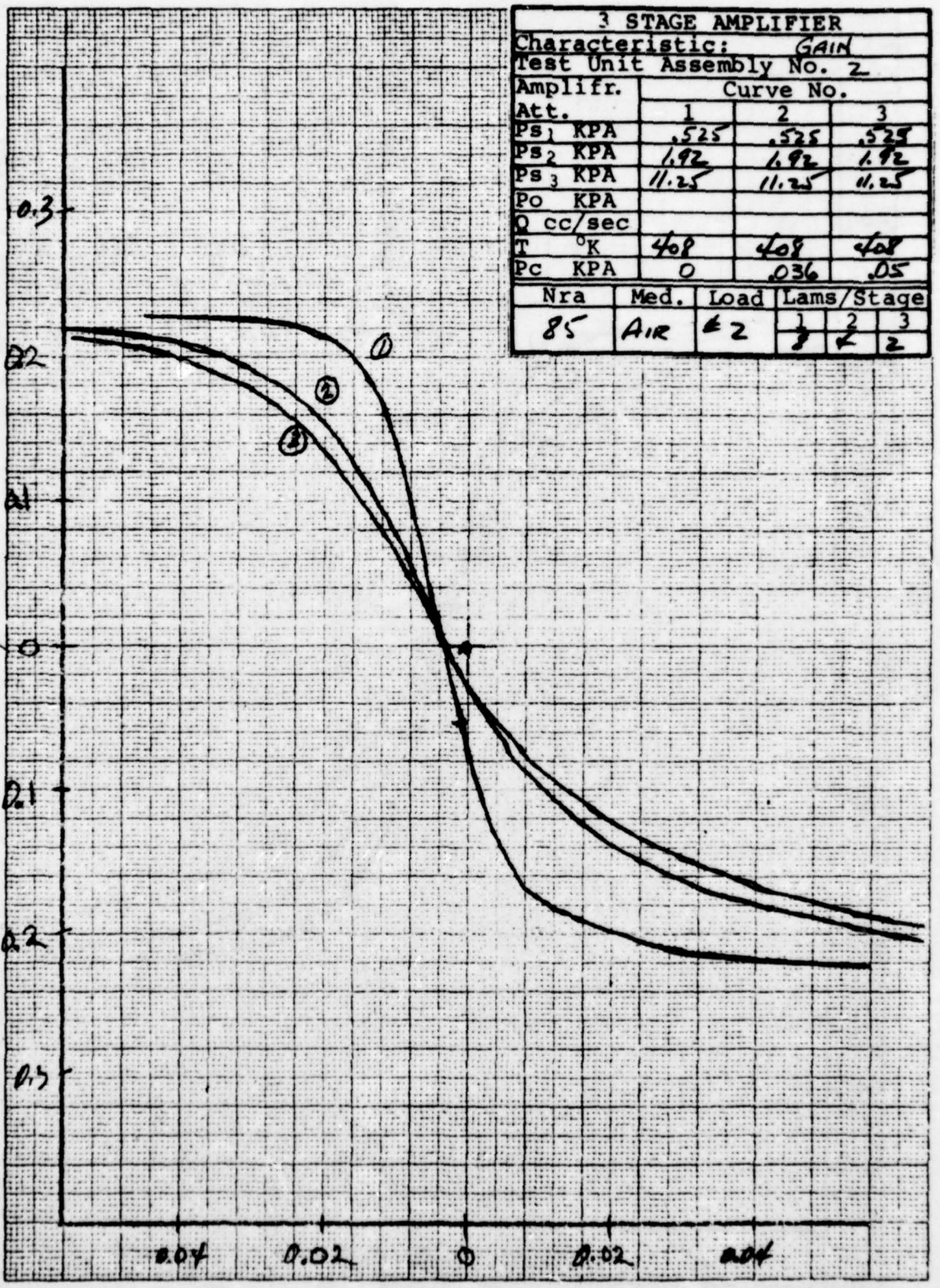

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 2
Amplifr. Att. | Curve No. 1 | 2 | 3
Ps1 KPA | .059 | .059 | .059
Ps2 KPA | .218 | .218 | .218
Ps3 KPA | 1.27 | 1.27 | 1.27
Po KPA | | | |
Q cc/sec | | | |
T °K | 298 | 298 | 298
Pc KPA | 0 | .003 | .006
Nra | Med. | Load | Lams/Stage 1 | 2 | 3
42.5 | AIR | ∞ | 7 | 4 | 2
0.3
0.2
0.1
0
0.1
0.2
0.3
0.004
0.002
0
0.002
0.004
ΔPo, kPa
ΔPc, kPa

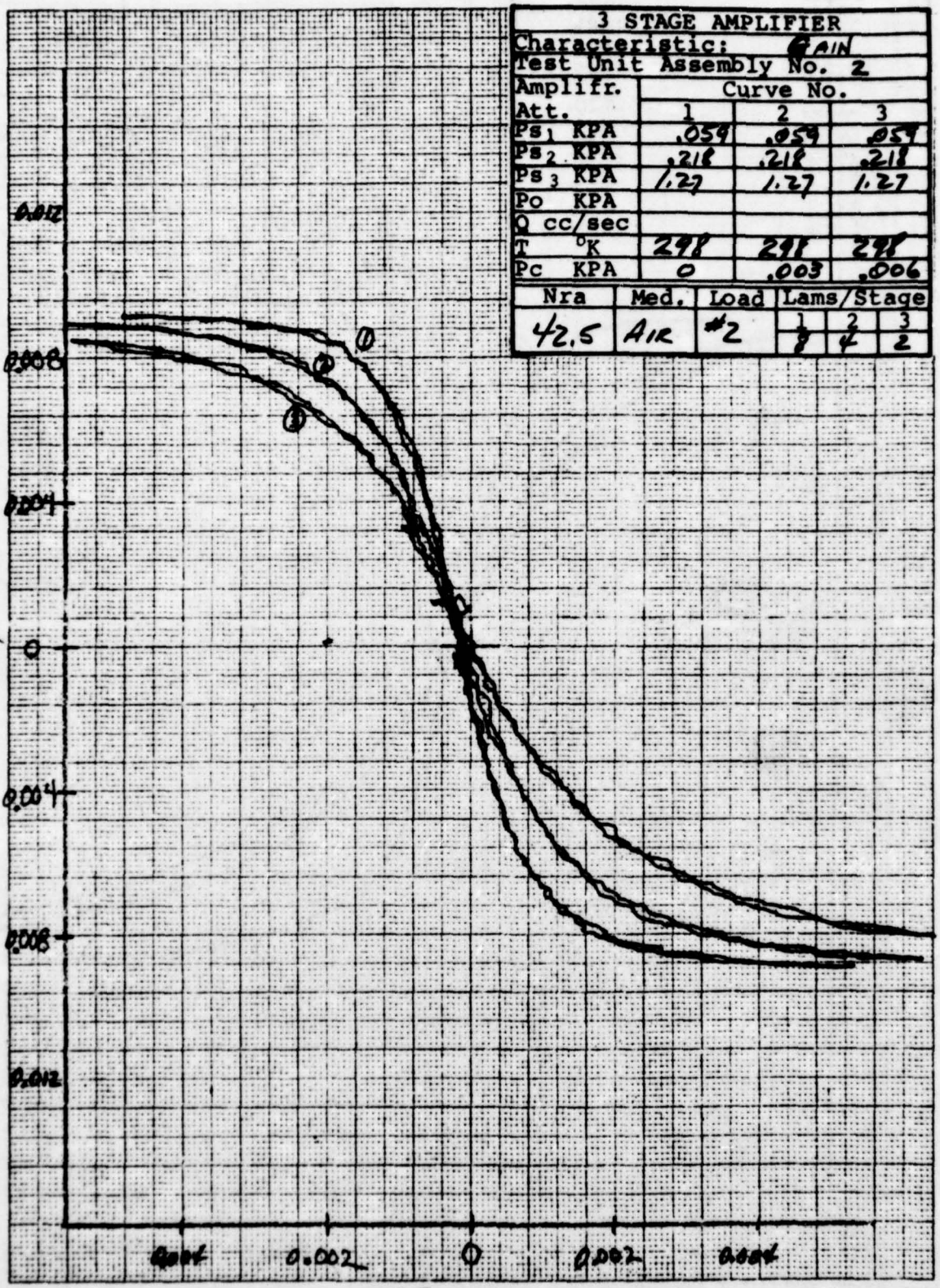

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 2
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .093 .093 .093
Ps2 KPA .34 .34 .34
Ps3 KPA 2.0 2.0 2.0
Po KPA
Q cc/sec
T °K 353 353 353
Pc KPA 0 .0045 .009
Nra 42.5
Med. Air
Load ∞
Lams/Stage 1/8 2/4 3/2
0.6
0.4
0.2
0
0.2
0.4
0.6
0.008
0.004
0
0.004
0.008
ΔPc, kPa
ΔPa, kPa
1
2
3

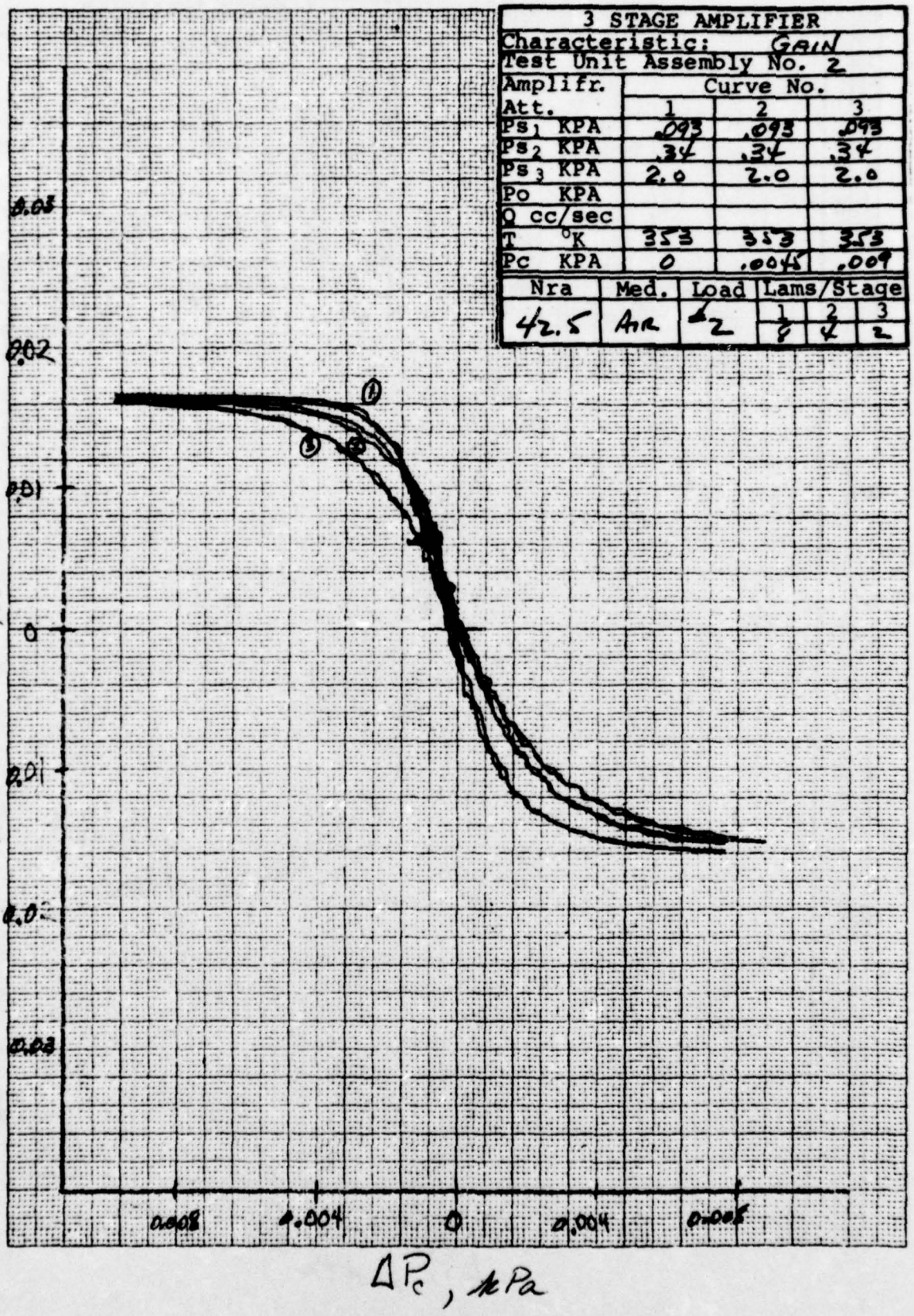

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 2
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .132 .132 .132
Ps2 KPA .48 .48 .48
Ps3 KPA 2.8 2.8 2.8
Po KPA
Q cc/sec
T °K 408 408 408
Pc KPA 0 .005 .01
Nra 42.5
Med. AIR
Load ∞
Lams/Stage 1/8 2/4 3/2
0.6
0.4
0.2
0
0.2
0.4
0.6
0.008
0.004
0
0.004
0.008
ΔPc, kPa
L, kPa

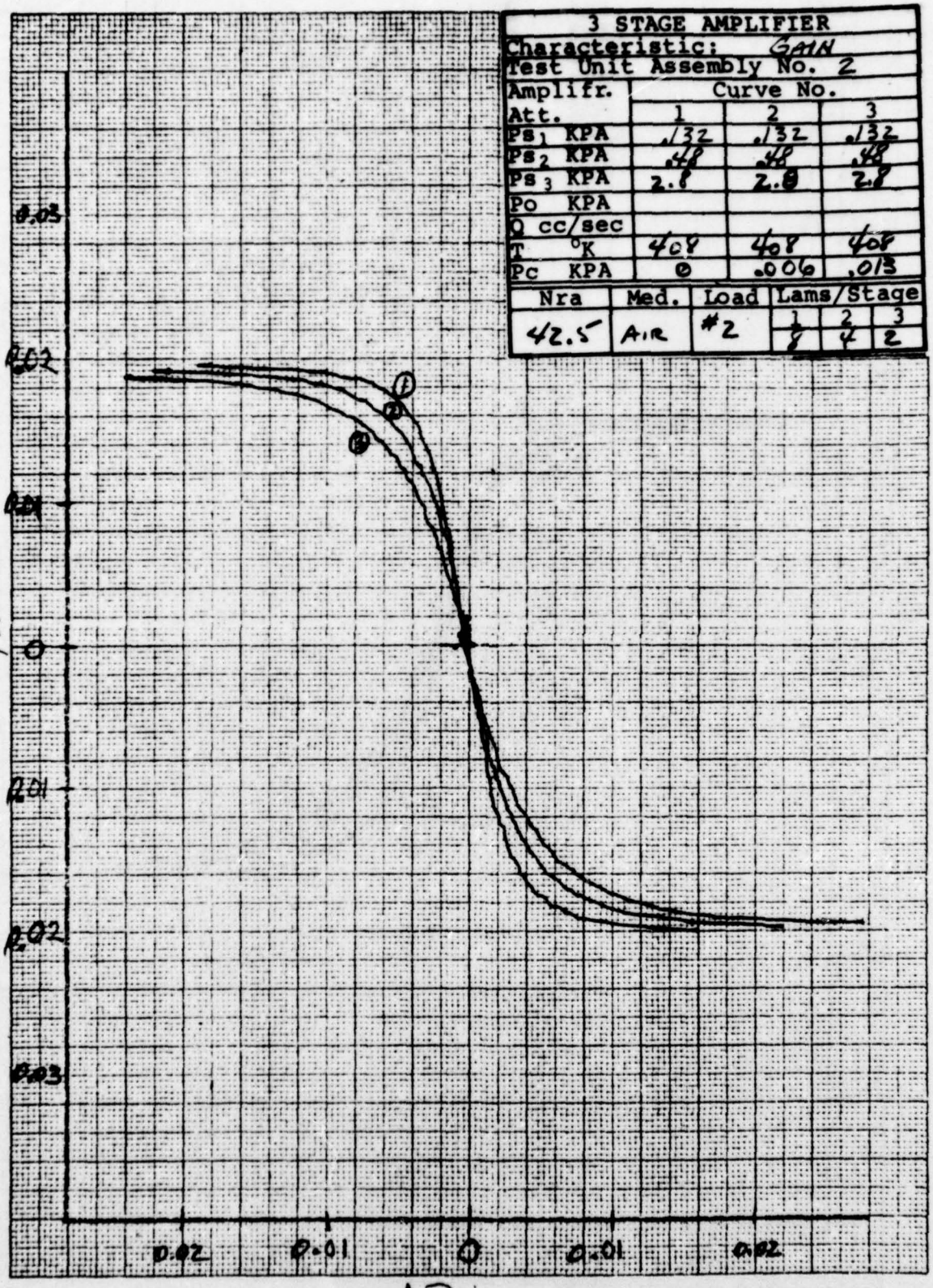

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 2
Amplifr. | Curve No. | 1 | 2 | 3
Att.
Ps1 KPA | .24 | .24 | .24
Ps2 KPA | .89 | .89 | .89
Ps3 KPA | 5.2 | 5.2 | 5.2
Po KPA
Q cc/sec
T °K | 298 | 298 | 298
Pc KPA | 0 | .012 | .024
Nra | Med. | Load | Lams/Stage 1 2 3
85 | AIR | #2 | 1 4 2
.12
.08
.04
0
.04
.08
.12
ΔPo, kPa
0.02
0.01
0
0.01
0.02
ΔPc, kPa

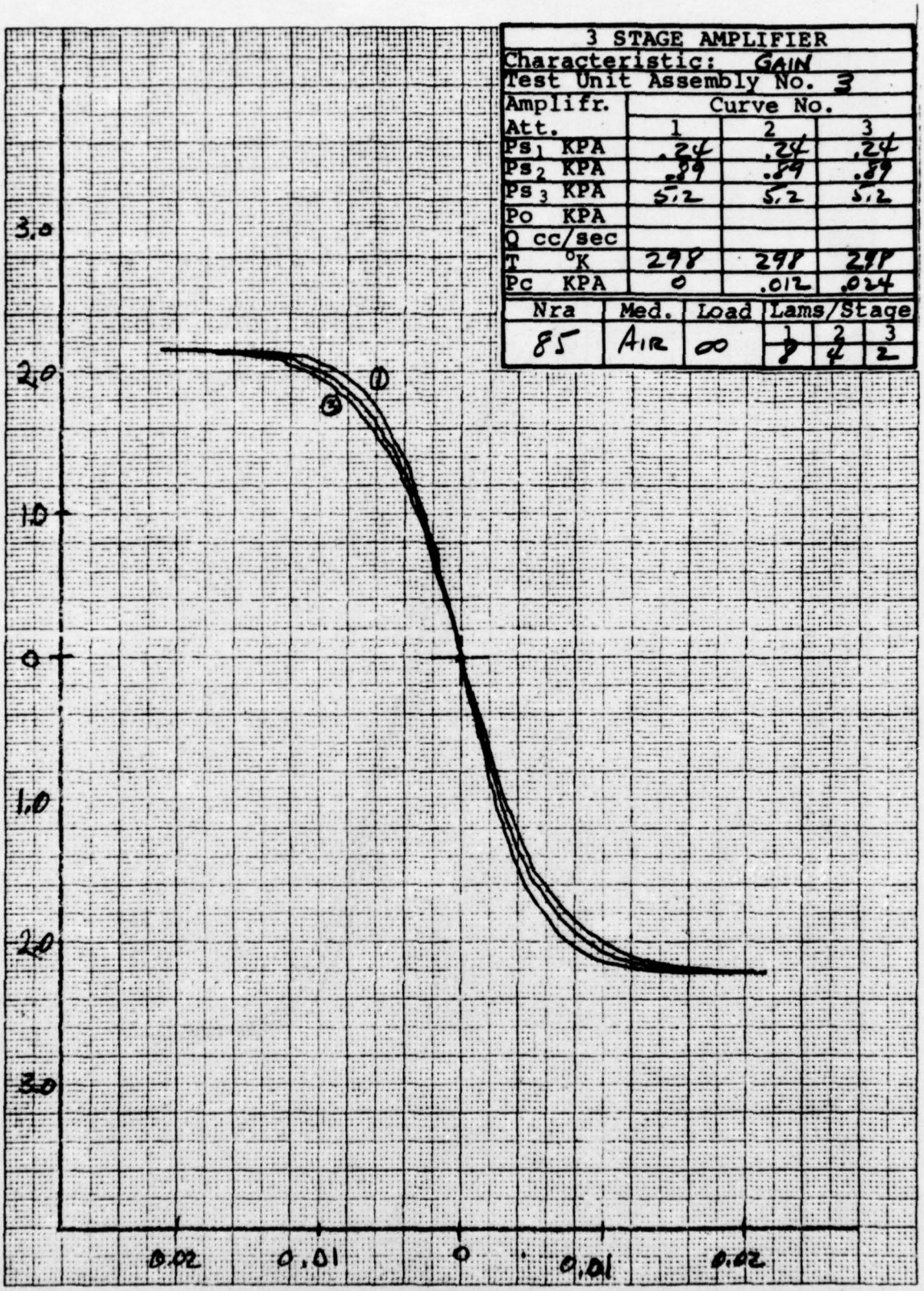

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 2
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .37 .37 .37
Ps2 KPA 1.35 1.35 1.35
Ps3 KPA 7.9 7.9 7.9
Po KPA
Q cc/sec
T °K 353 353 353
Pc KPA 0 .018 .037
Nra 85
Med. Air
Load 2
Lams/Stage 1/8 2/4 3/2
0.12
0.08
0.04
0
0.04
0.08
0.12
0.02
0.01
0
0.01
0.02
ΔPb, kPa
ΔPc, kPa

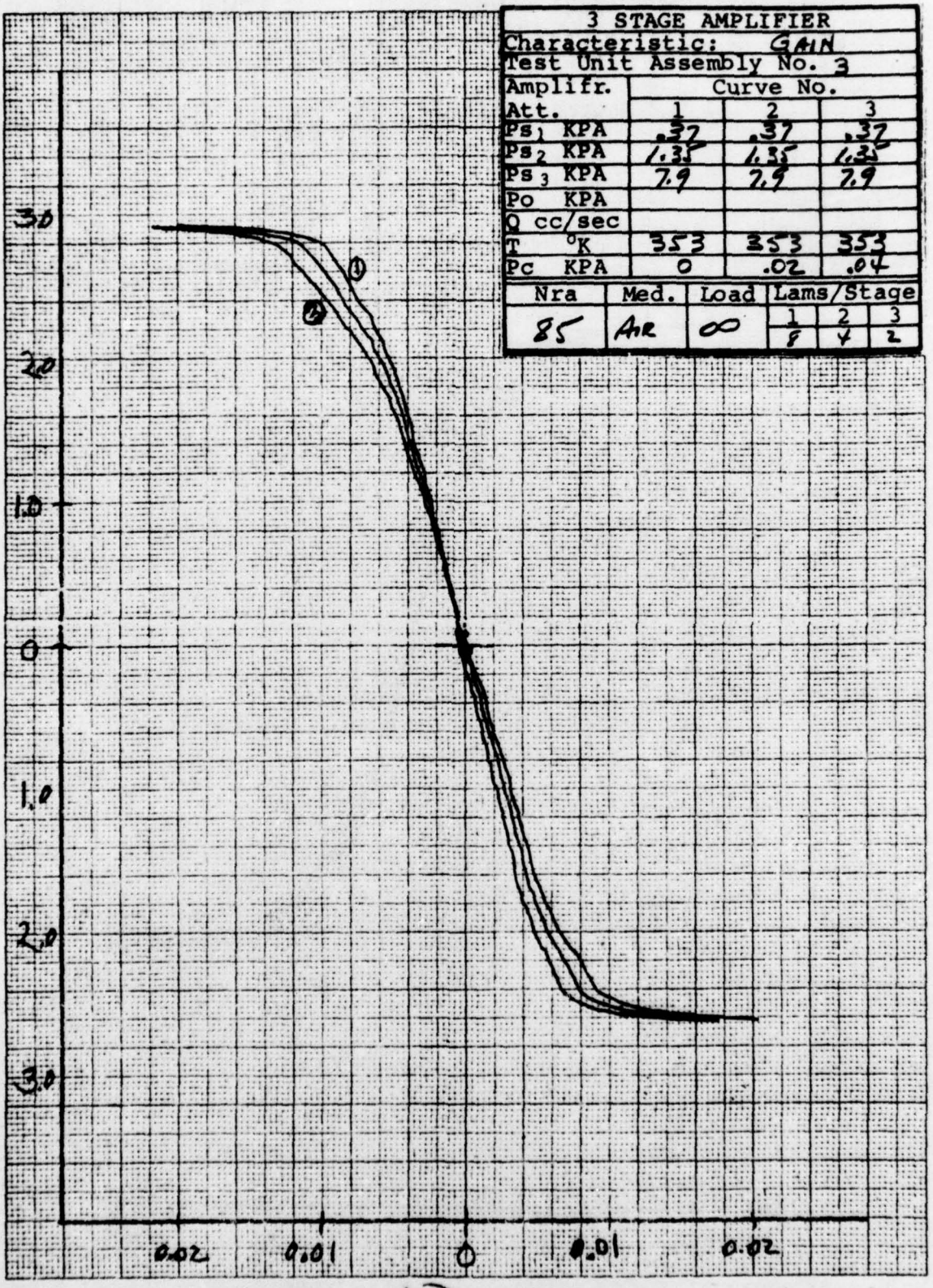

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 2
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .525 .525 .525
Ps2 KPA 1.92 1.92 1.92
Ps3 KPA 11.25 11.25 11.25
Po KPA
Q cc/sec
T °K 408 408 408
Pc KPA 0 .036 .05
Nra 85
Med. AIR
Load ∞2
Lams/Stage 1 2 3
0.3
0.2
0.1
0
0.1
0.2
0.3
0.04
0.02
0
0.02
0.04
ΔP, kPa
ΔP, kPa

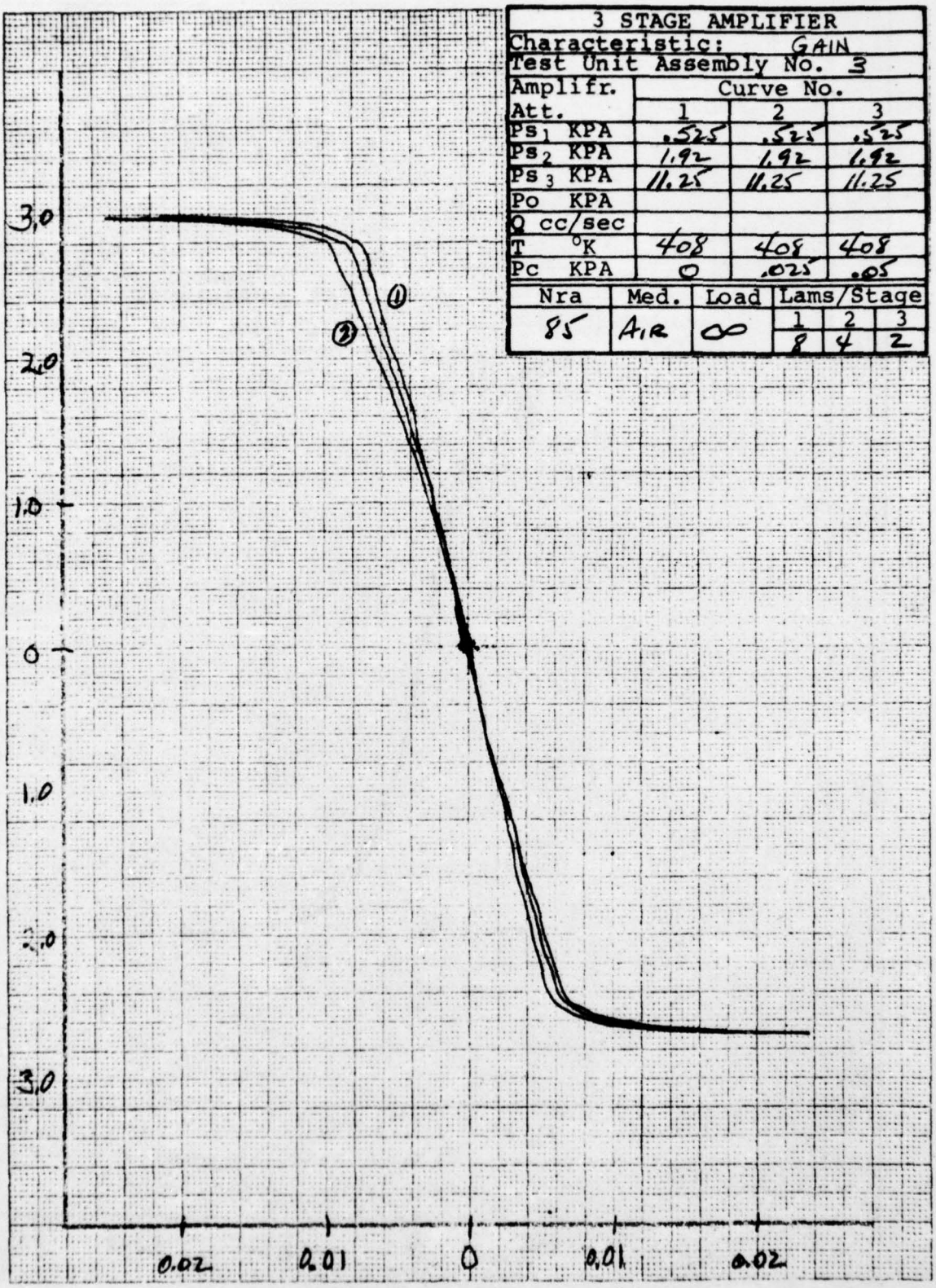

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 2
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .059 .059 .059
Ps2 KPA .218 .218 .218
Ps3 KPA 1.27 1.27 1.27
Po KPA
Q cc/sec
T °K 298 298 298
Pc KPA 0 .003 .006
Nra 42.5
Med. AIR
Load #2
Lams/Stage 1/8 2/4 3/2
0.012
0.008
0.004
0
0.004
0.008
0.012
0.004
0.002
0
0.002
0.004
ΔPc, kPa
ΔPc, kPa

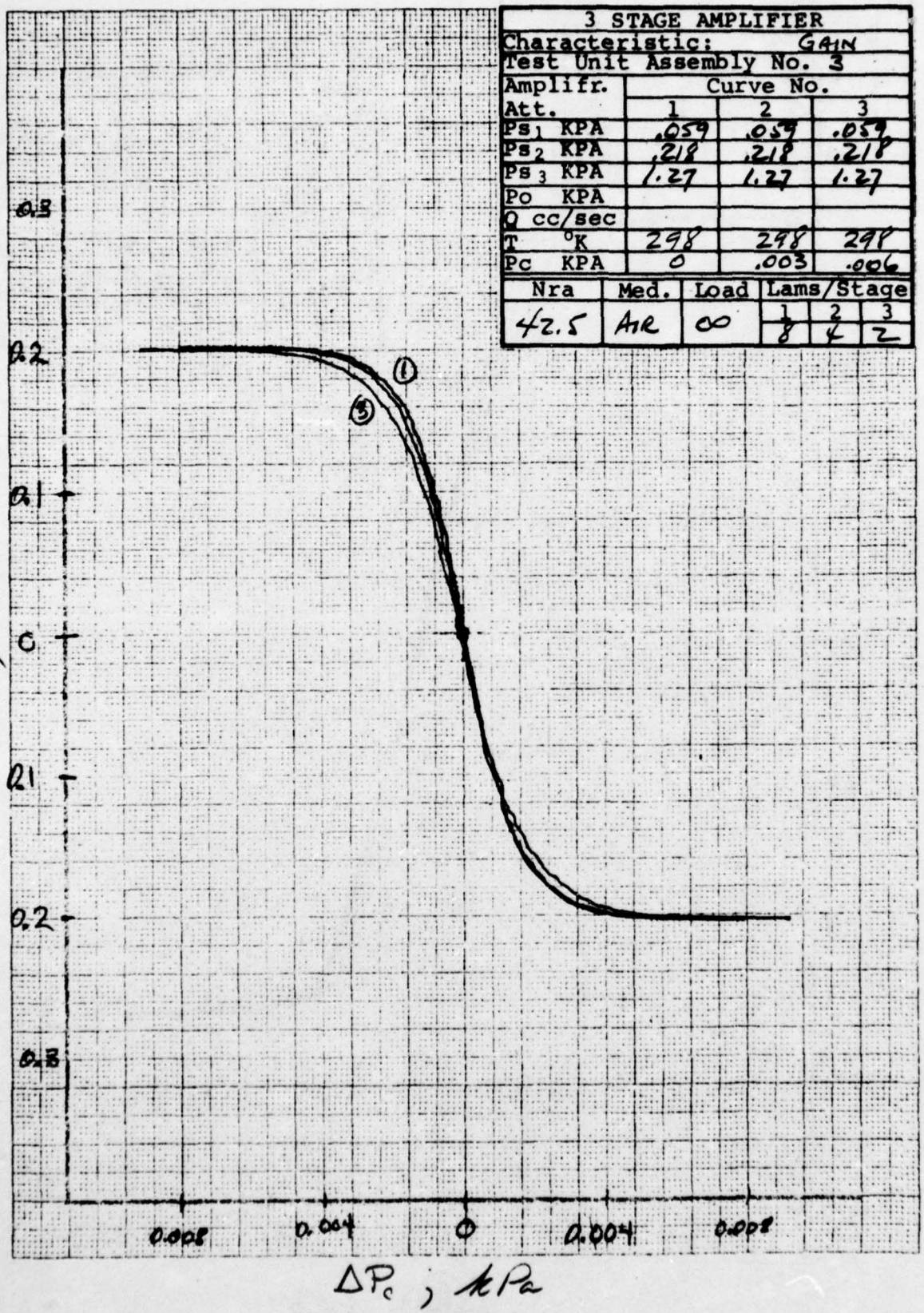

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 2
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .093 .093 .093
Ps2 KPA .34 .34 .34
Ps3 KPA 2.0 2.0 2.0
Po KPA
Q cc/sec
T °K 353 353 353
Pc KPA 0 .0045 .009
Nra 42.5
Med. Air
Load 2
Lams/Stage 1 2 3 / 8 4 2
0.03
0.02
0.01
0
0.01
0.02
0.03
0.008
0.004
0
0.004
0.008
ΔPc, kPa
ΔPc, kPa

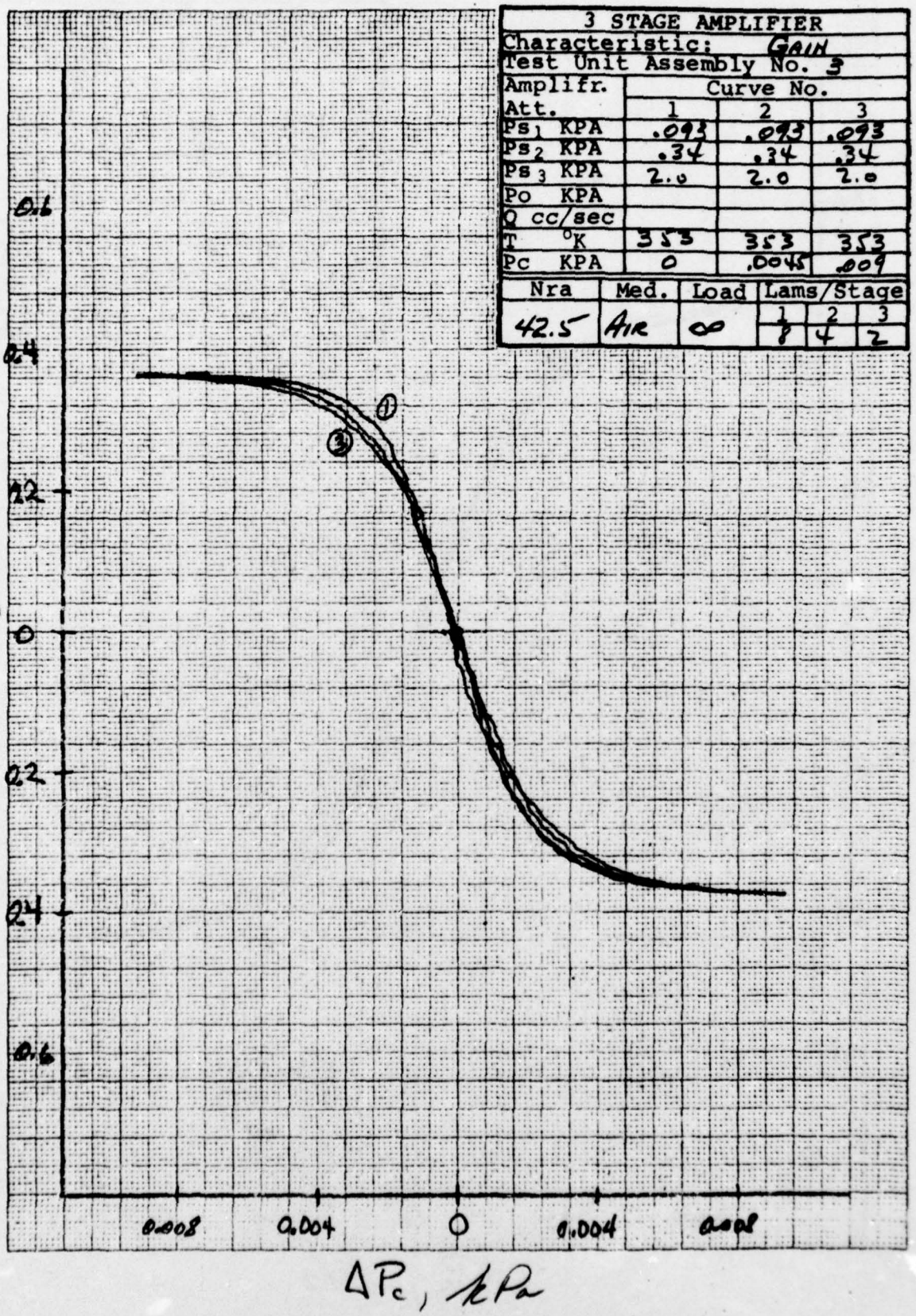

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 2
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .132 .132 .132
Ps2 KPA .48 .48 .48
Ps3 KPA 2.8 2.8 2.8
Po KPA
Q cc/sec
T °K 408 408 408
Pc KPA 0 .006 .013
Nra 42.5
Med. AIR
Load #2
Lams/Stage 1 2 3 / 8 4 2
0.03
0.02
0.01
0
0.01
0.02
0.03
0.02
0.01
0
0.01
0.02
ΔPc, kPa
ΔPc, kPa

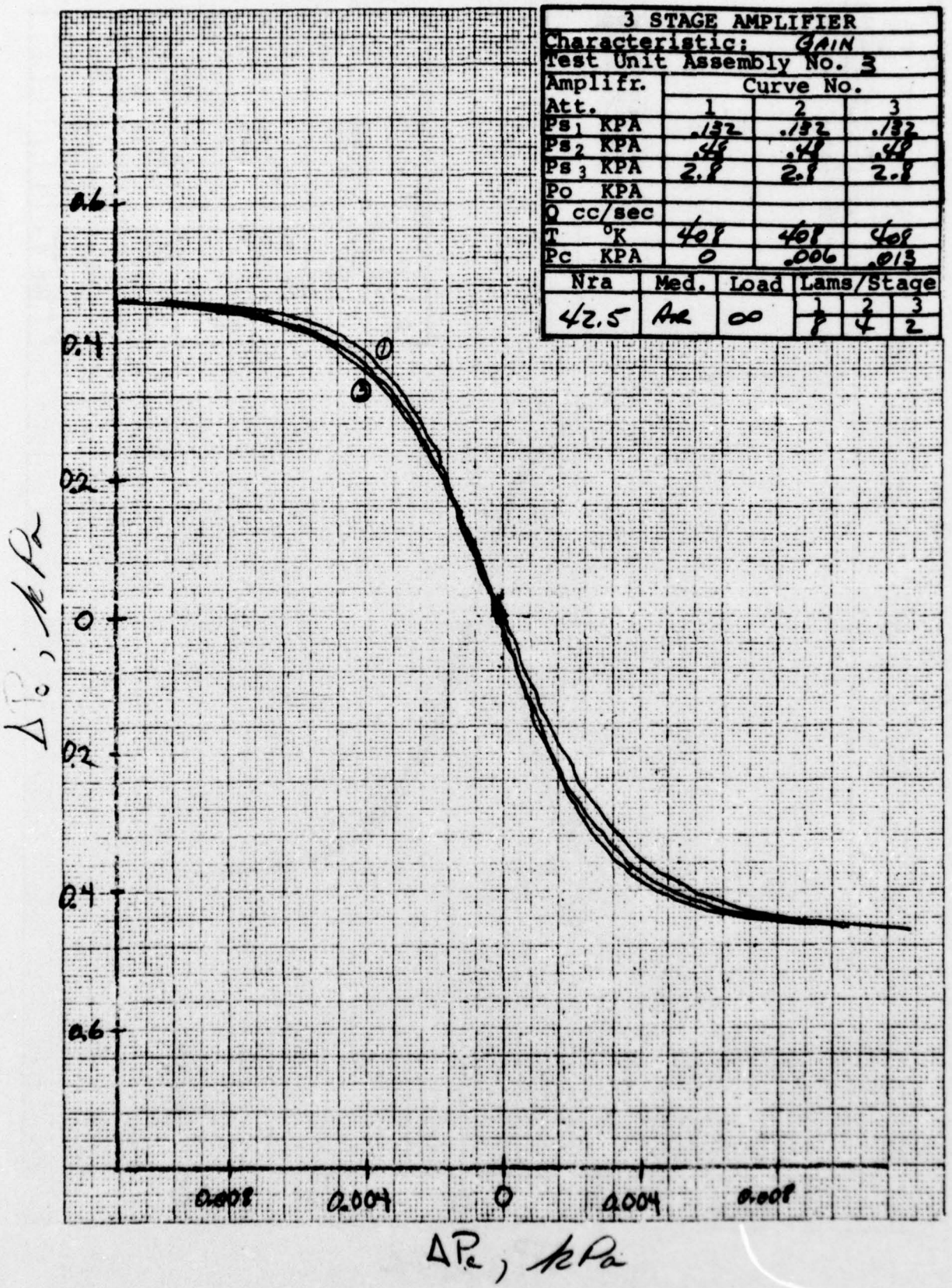

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .24 .24 .24
Ps2 KPA .89 .89 .89
Ps3 KPA 5.2 5.2 5.2
Po KPA
Q cc/sec
T °K 298 298 298
Pc KPA 0 .012 .024
Nra 85
Med. Air
Load ∞
Lams/Stage 1 3 2 2 3 2
3.0
2.0
1.0
0
1.0
2.0
3.0
0.02
0.01
0
0.01
0.02
ΔPc, kPa
P, kPa


3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .37 .37 .37
Ps2 KPA 1.35 1.35 1.35
Ps3 KPA 7.9 7.9 7.9
Po KPA
Q cc/sec
T °K 353 353 353
Pc KPA 0 .02 .04
Nra 85
Med. Air
Load ∞
Lams/Stage 1 2 3 / 8 4 2
3.0
2.0
1.0
0
1.0
2.0
3.0
0.02
0.01
0
0.01
0.02
ΔPo, kPa
ΔPc, kPa


3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .525 .525 .525
Ps2 KPA 1.92 1.92 1.92
Ps3 KPA 11.25 11.25 11.25
Po KPA
Q cc/sec
T °K 408 408 408
Pc KPA 0 .025 .05
Nra 85
Med. AIR
Load ∞
Lams/Stage 1 2 3
8 4 2
3.0
2.0
1.0
0
1.0
2.0
3.0
0.02
0.01
0
0.01
0.02
ΔPc, kPa

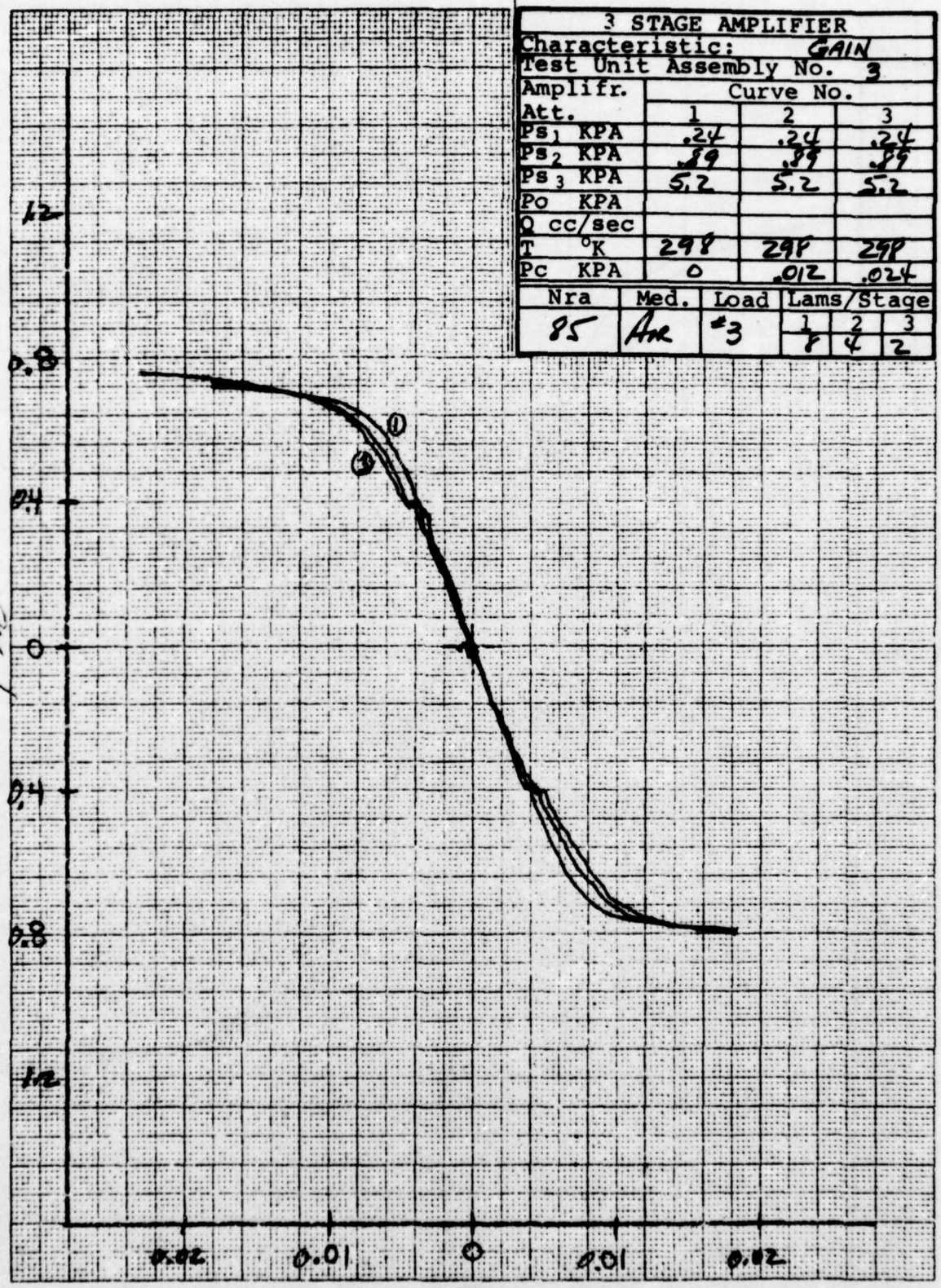

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .059 .059 .059
Ps2 KPA .218 .218 .218
Ps3 KPA 1.27 1.27 1.27
Po KPA
Q cc/sec
T °K 298 298 298
Pc KPA 0 .003 .006
Nra 42.5
Med. Air
Load ∞
Lams/Stage 1/8 2/4 3/2
0.3
0.2
0.1
0
0.1
0.2
0.3
0.008
0.004
0
0.004
0.008
ΔPc, kPa
ΔPo, kPa
1
3

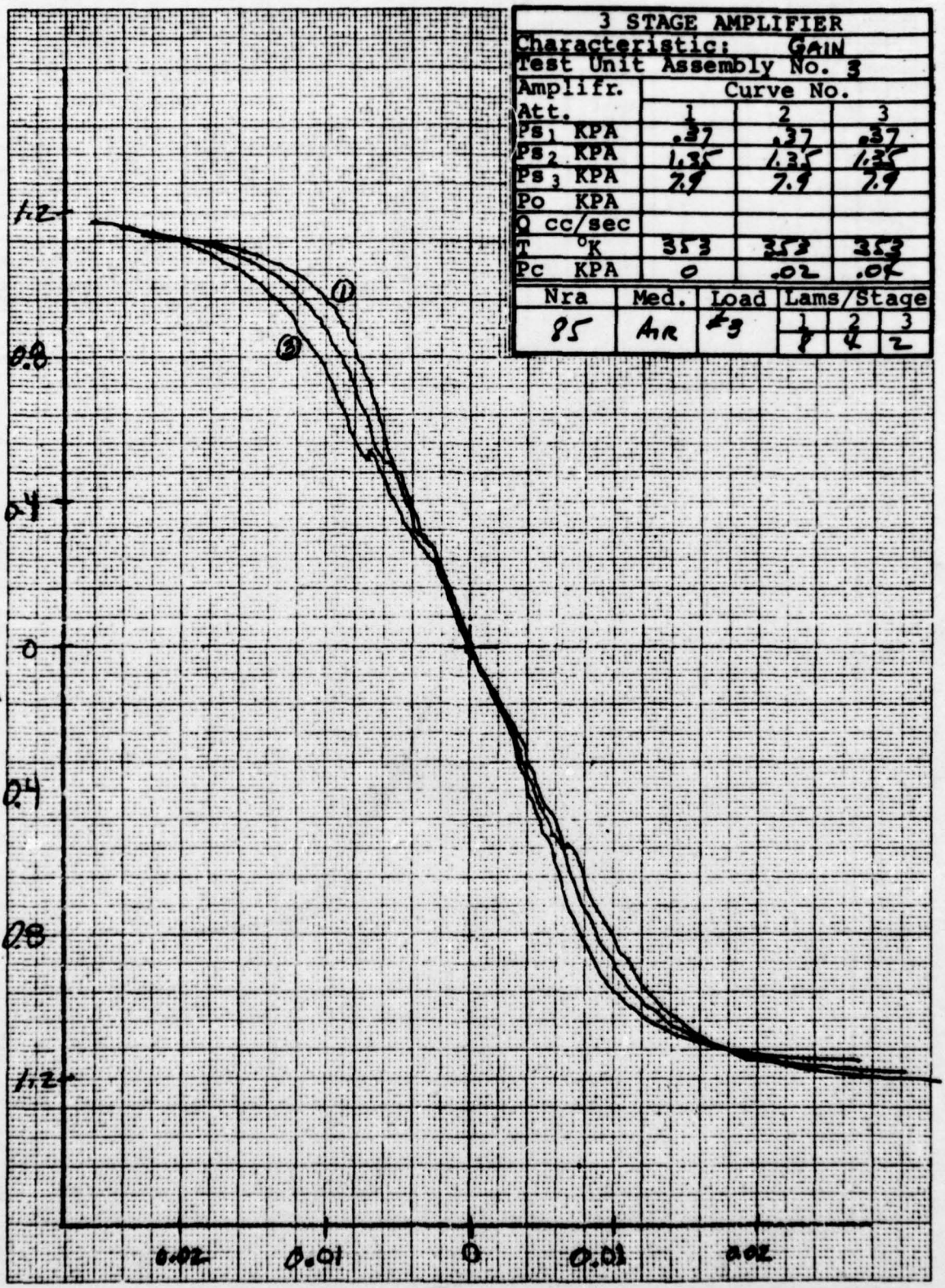

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .093 .093 .093
Ps2 KPA .34 .34 .34
Ps3 KPA 2.0 2.0 2.0
Po KPA
Q cc/sec
T °K 353 353 353
Pc KPA 0 .0045 .009
Nra 42.5
Med. Air
Load ∞
Lams/Stage 1/8 2/4 3/2
0.6
0.4
0.2
0
0.2
0.4
0.6
0.008
0.004
0
0.004
0.008
ΔPo, kPa
ΔPc, kPa

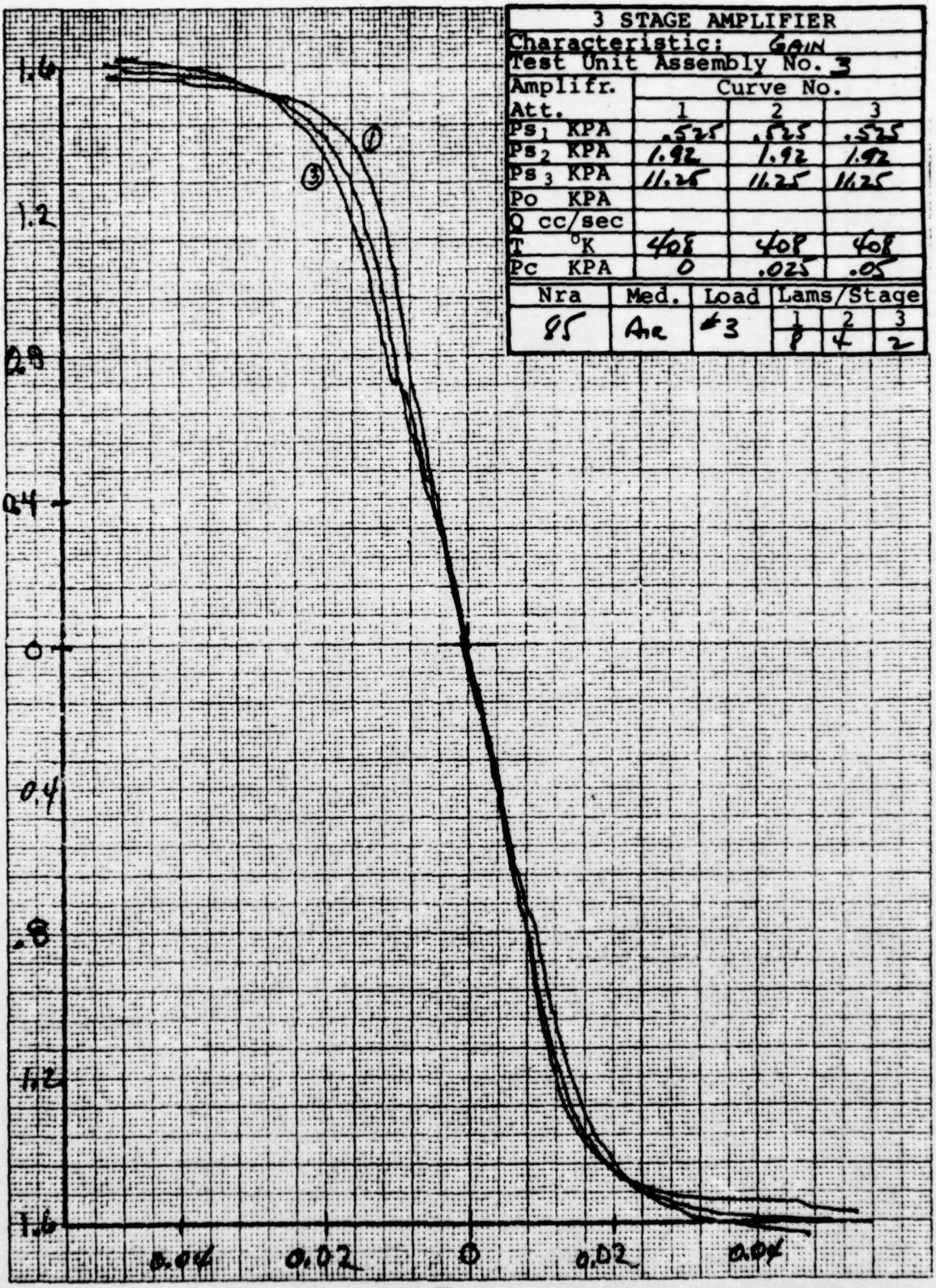

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Att.
Curve No.
1 2 3
Ps1 KPA .132 .132 .132
Ps2 KPA .46 .48 .48
Ps3 KPA 2.8 2.8 2.8
Po KPA
Q cc/sec
T °K 408 408 408
Pc KPA 0 .006 .013
Nra 42.5
Med. Air
Load ∞
Lams/Stage 1 8 2 4 3 2
0.6
0.4
0.2
0
0.2
0.4
0.6
0.008
0.004
0
0.004
0.008
ΔPc, kPa
ΔPa, kPa

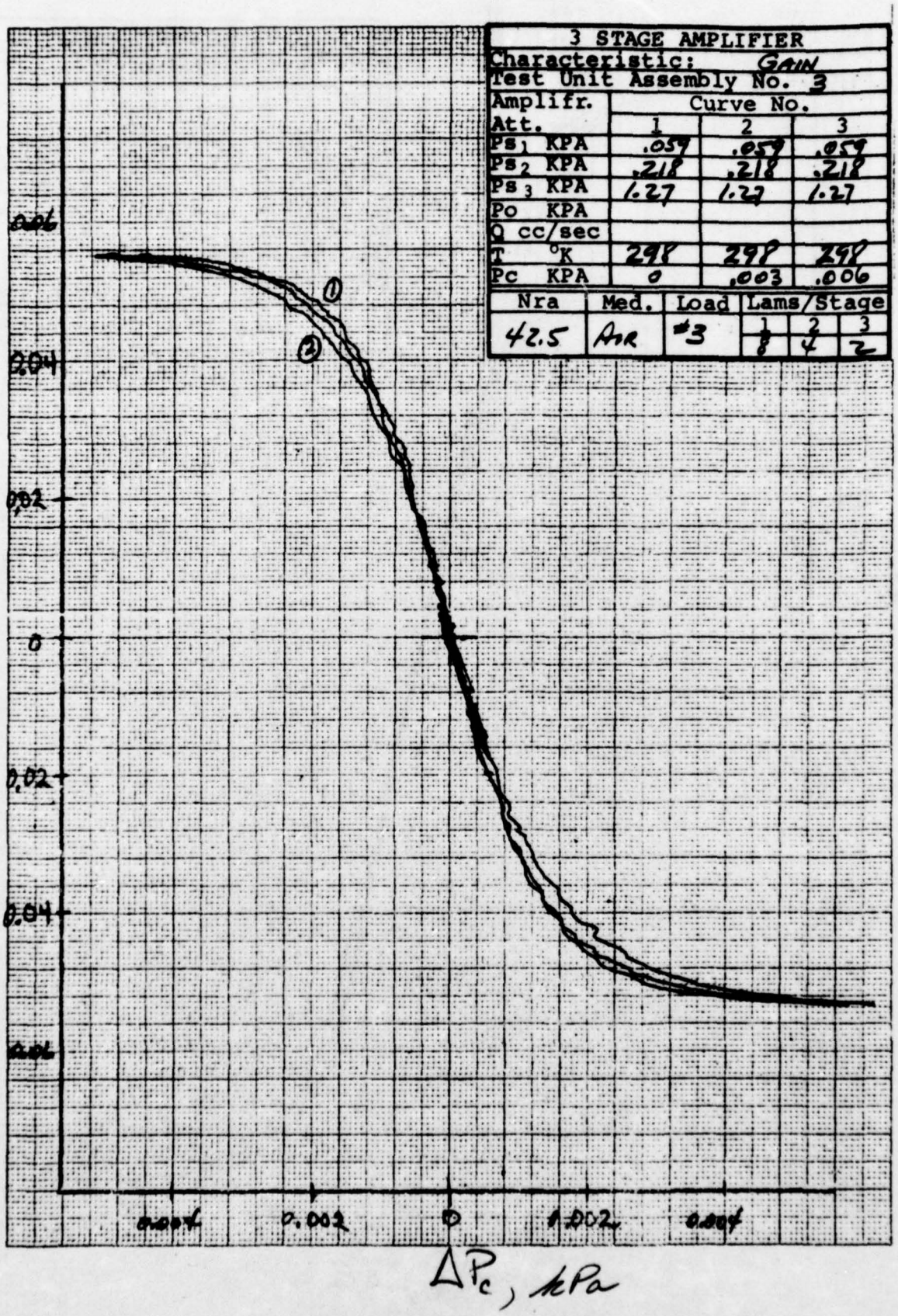
| 3 STAGE AMPLIFIER | | | |
|---|---|---|---|
| Characteristic: GAIN | | | |
| Test Unit Assembly No. 3 | | | |
| Amplifr. Att. | Curve No. 1 | Curve No. 2 | Curve No. 3 |
| $Ps_1$ KPA | .24 | .24 | .24 |
| $Ps_2$ KPA | .89 | .89 | .89 |
| $Ps_3$ KPA | 5.2 | 5.2 | 5.2 |
| Po KPA | | | |
| Q cc/sec | | | |
| T °K | 298 | 298 | 298 |
| Pc KPA | 0 | .012 | .024 |

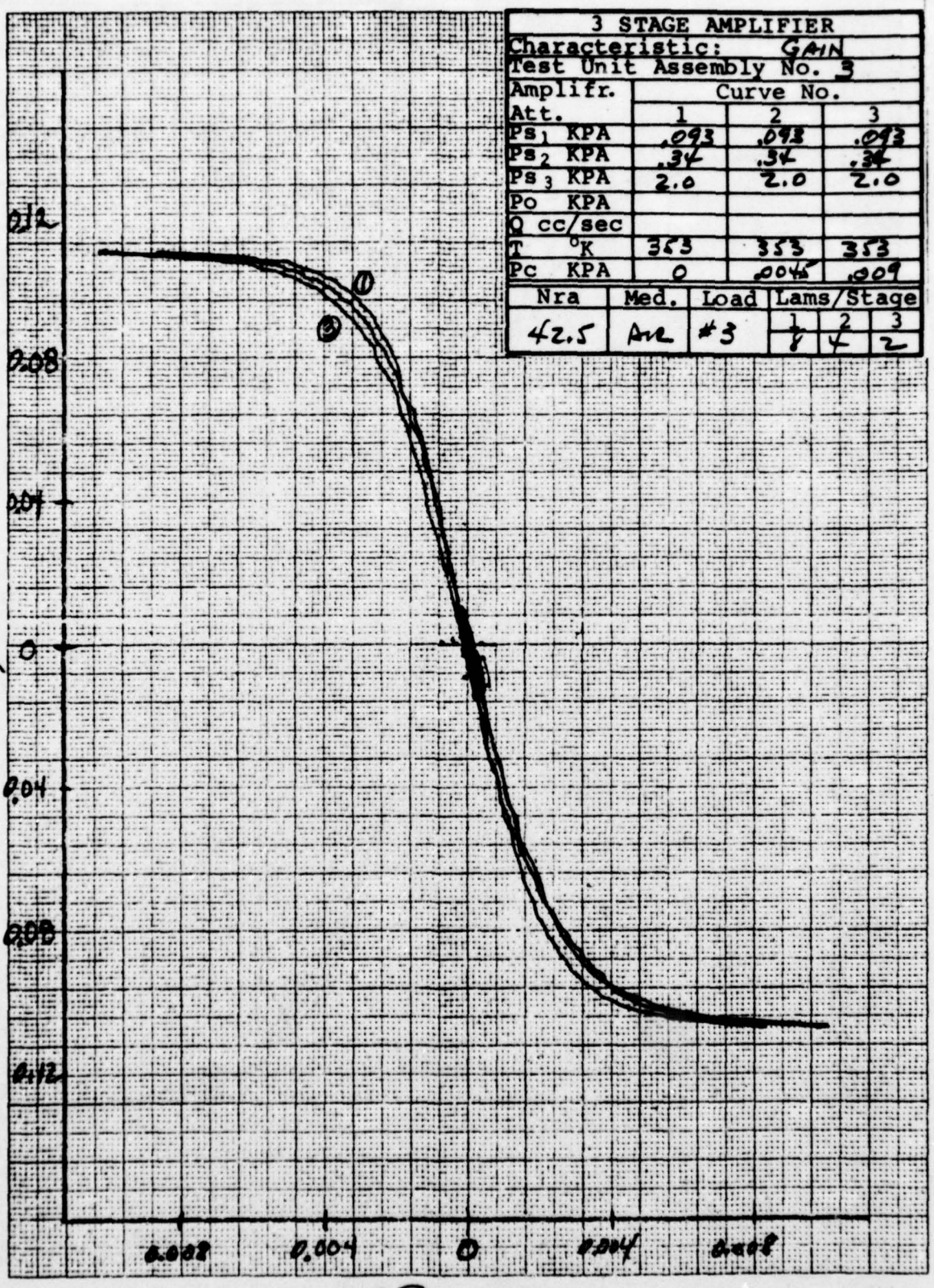
| Nra | Med. | Load | Lams/Stage 1 | 2 | 3 |
|---|---|---|---|---|---|
| 85 | Air | #3 | 1 | 4 | 2 |

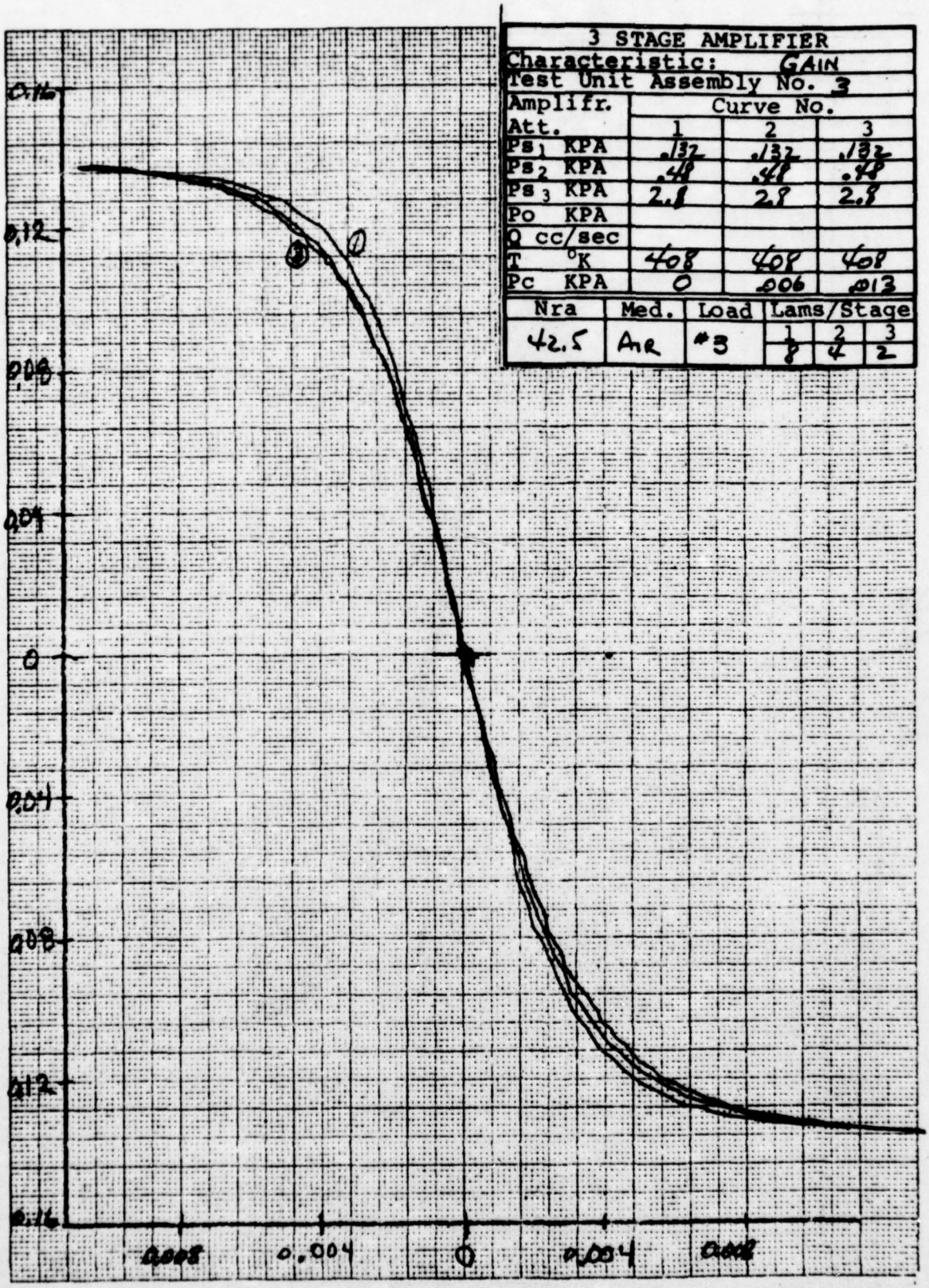


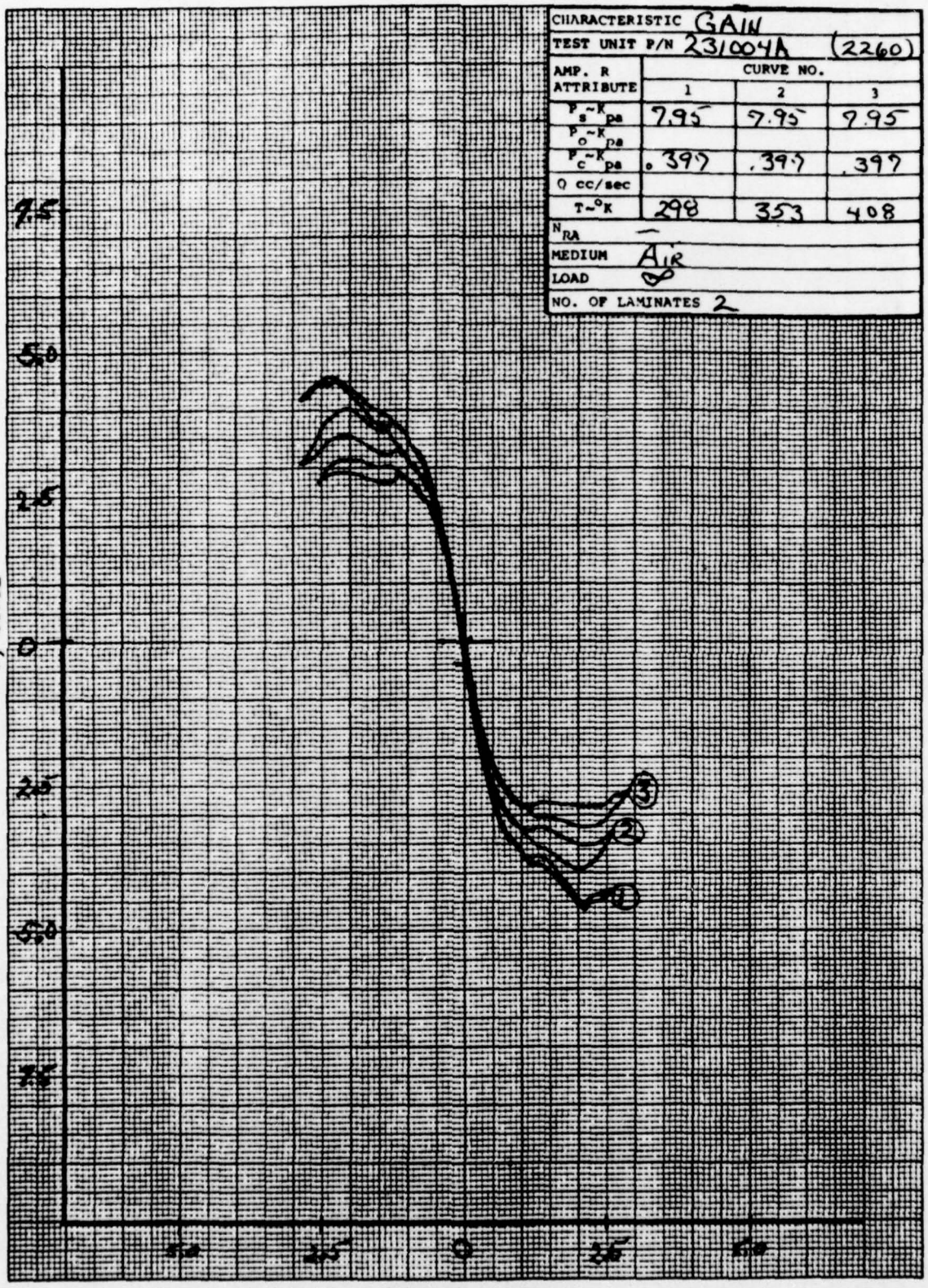

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .37 .37 .37
Ps2 KPA 1.35 1.35 1.35
Ps3 KPA 7.9 7.9 7.9
Po KPA
Q cc/sec
T °K 353 353 353
Pc KPA 0 .02 .04
Nra 85
Med. AIR
Load Lg
Lams/Stage 1 2 3 / 4 4 2
1.2
0.8
0.4
0
0.4
0.8
1.2
ΔPa, kPa
0.02
0.01
0
0.01
0.02
ΔPc, kPa
1
2
3

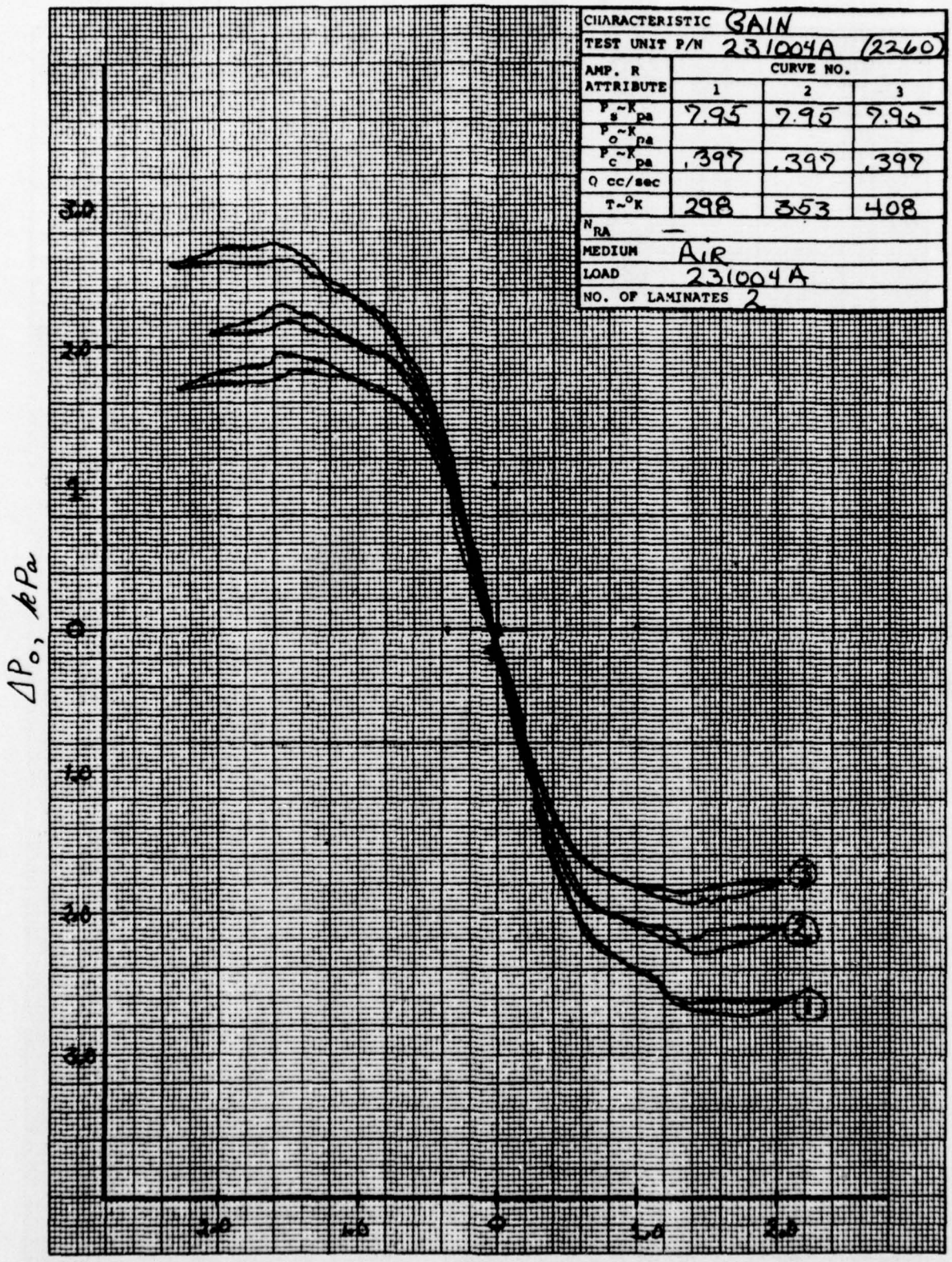

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .525 .525 .525
Ps2 KPA 1.92 1.92 1.92
Ps3 KPA 11.25 11.25 11.25
Po KPA
Q cc/sec
T °K 408 408 408
Pc KPA 0 .025 .05
Nra 85
Med. Air
Load #3
Lams/Stage 1 8 2 4 3 2
1.6
1.2
0.8
0.4
0
0.4
0.8
1.2
1.6
0.04
0.02
0
0.02
0.04
ΔP3, kPa
ΔPc, kPa

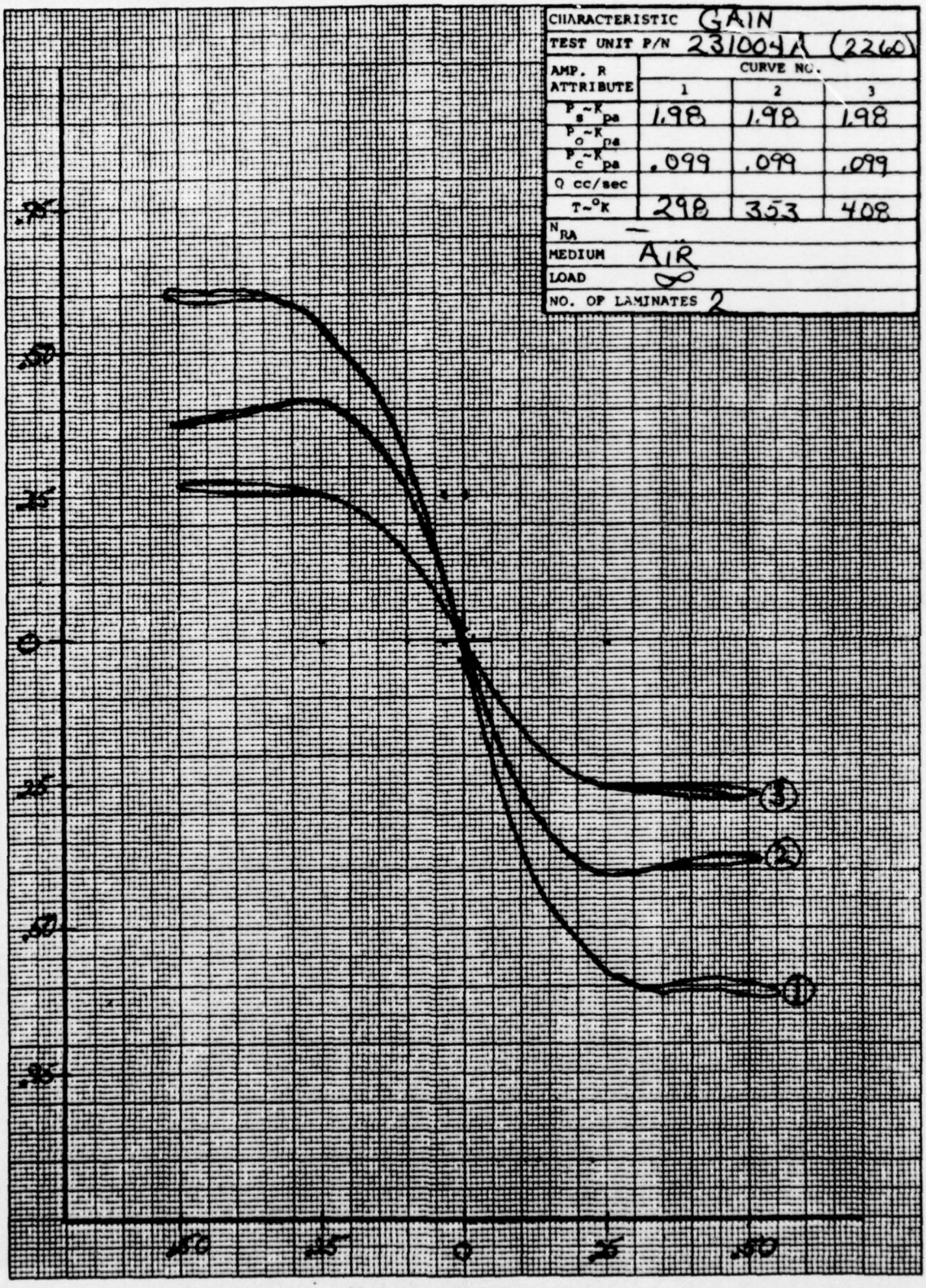

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .059 .059 .059
Ps2 KPA .218 .218 .218
Ps3 KPA 1.27 1.27 1.27
Po KPA
Q cc/sec
T °K 298 298 298
Pc KPA 0 .003 .006
Nra 42.5
Med. Air
Load #3
Lams/Stage 1 2 3 / 8 4 2
0.06
0.04
0.02
0
0.02
0.04
0.06
0.004
0.002
0
0.002
0.004
ΔPc, kPa
ΔPo, kPa
1
2

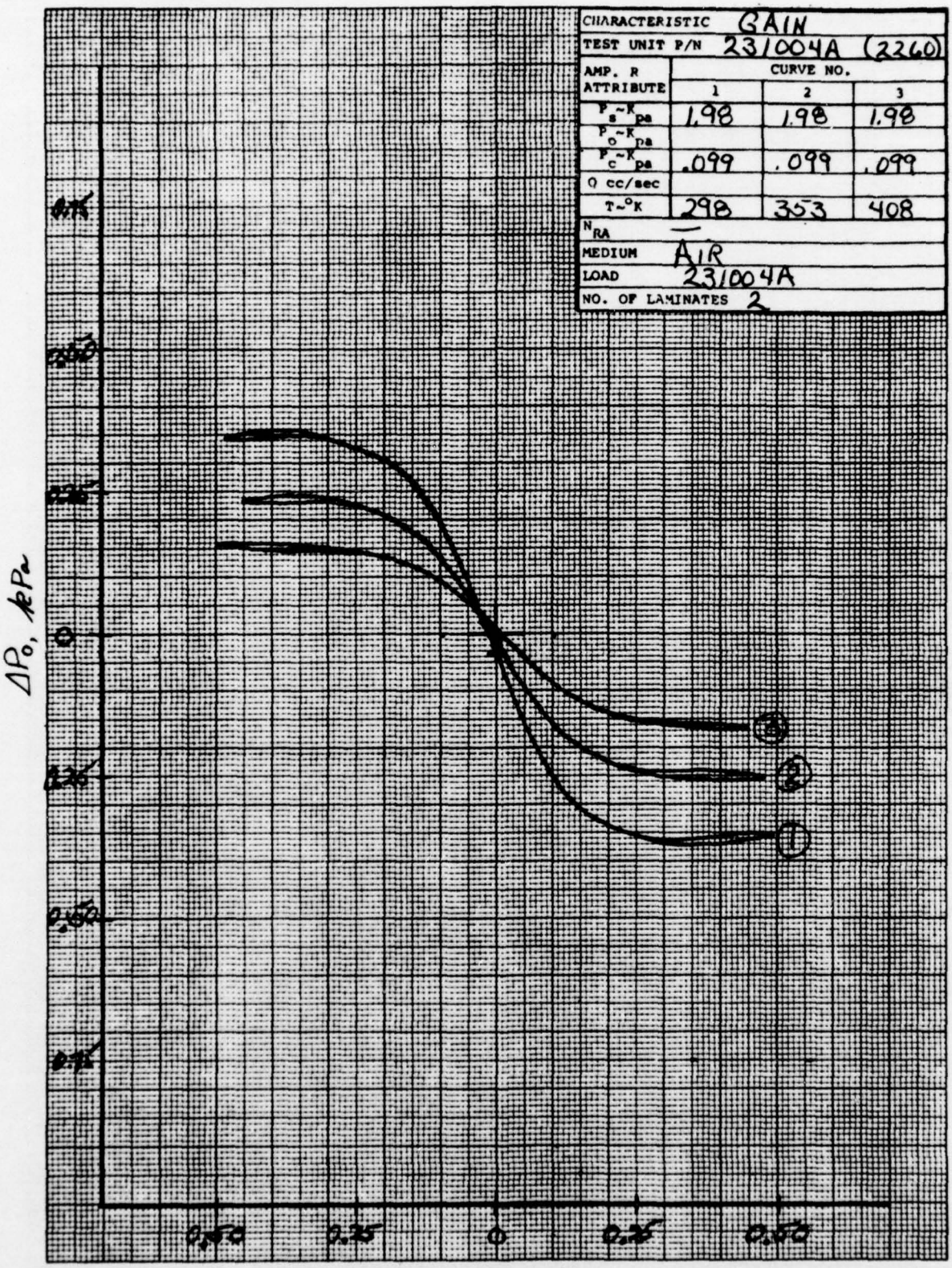

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. | Curve No. 1 | 2 | 3
Att.
Ps1 KPA | .093 | .093 | .093
Ps2 KPA | .34 | .34 | .34
Ps3 KPA | 2.0 | 2.0 | 2.0
Po KPA
Q cc/sec
T °K | 353 | 353 | 353
Pc KPA | 0 | .0045 | .009
Nra | Med. | Load | Lams/Stage 1 | 2 | 3
42.5 | Air | #3 | 1/8 | 4 | 2
0.12
0.08
0.04
0
0.04
0.08
0.12
ΔPo, kPa
0.002
0.004
0
0.004
0.008
ΔPc, kPa

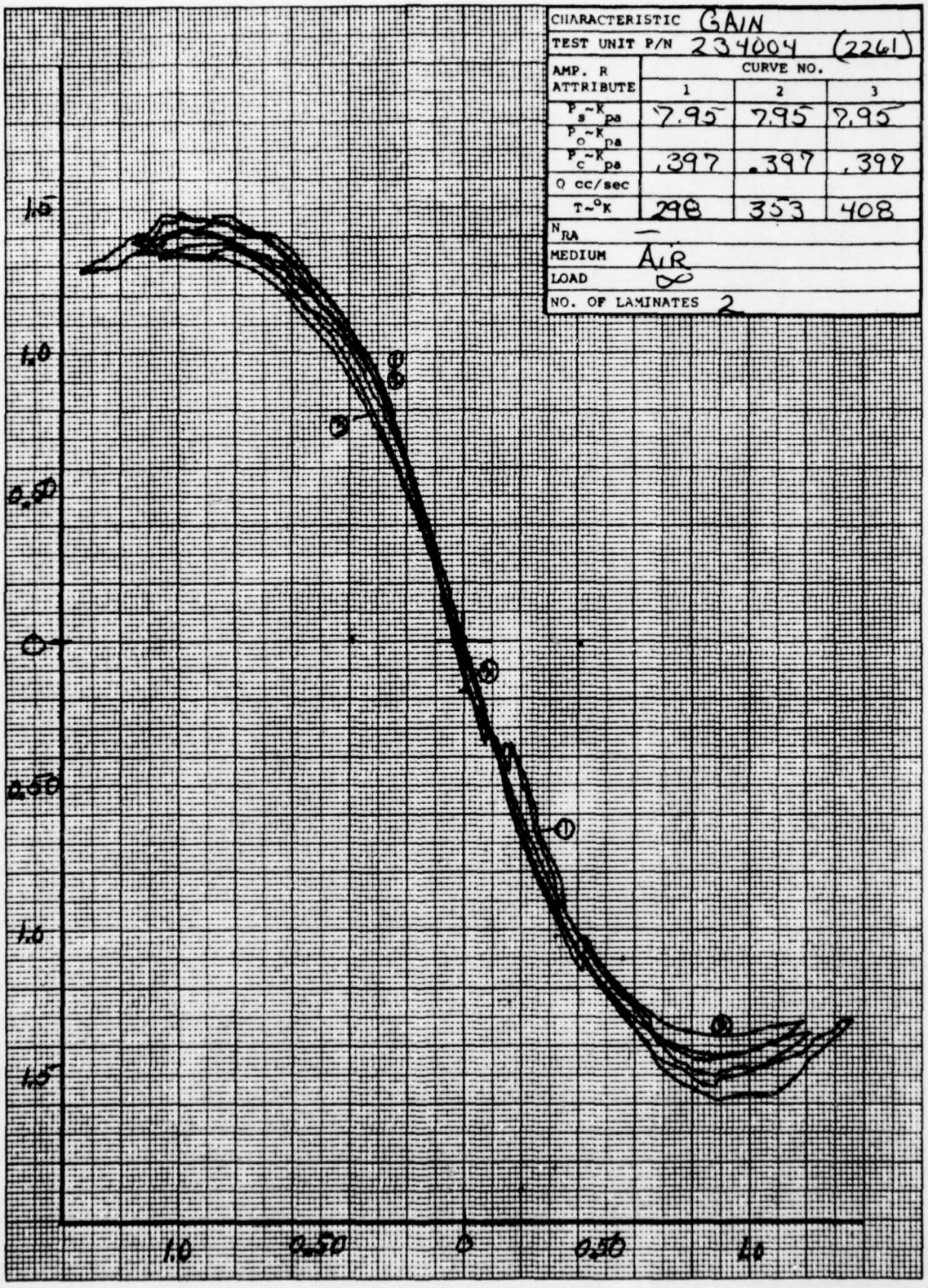

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .137 .137 .137
Ps2 KPA .48 .48 .48
Ps3 KPA 2.8 2.8 2.8
Po KPA
Q cc/sec
T °K 408 408 408
Pc KPA 0 .006 .013
Nra 42.5
Med. Air
Load #3
Lams/Stage 1/8 2/4 3/2
0.16
0.12
0.08
0.04
0
0.04
0.08
0.12
0.16
0.008
0.004
0
0.004
0.008
ΔPo, kPa
ΔPo, kPa

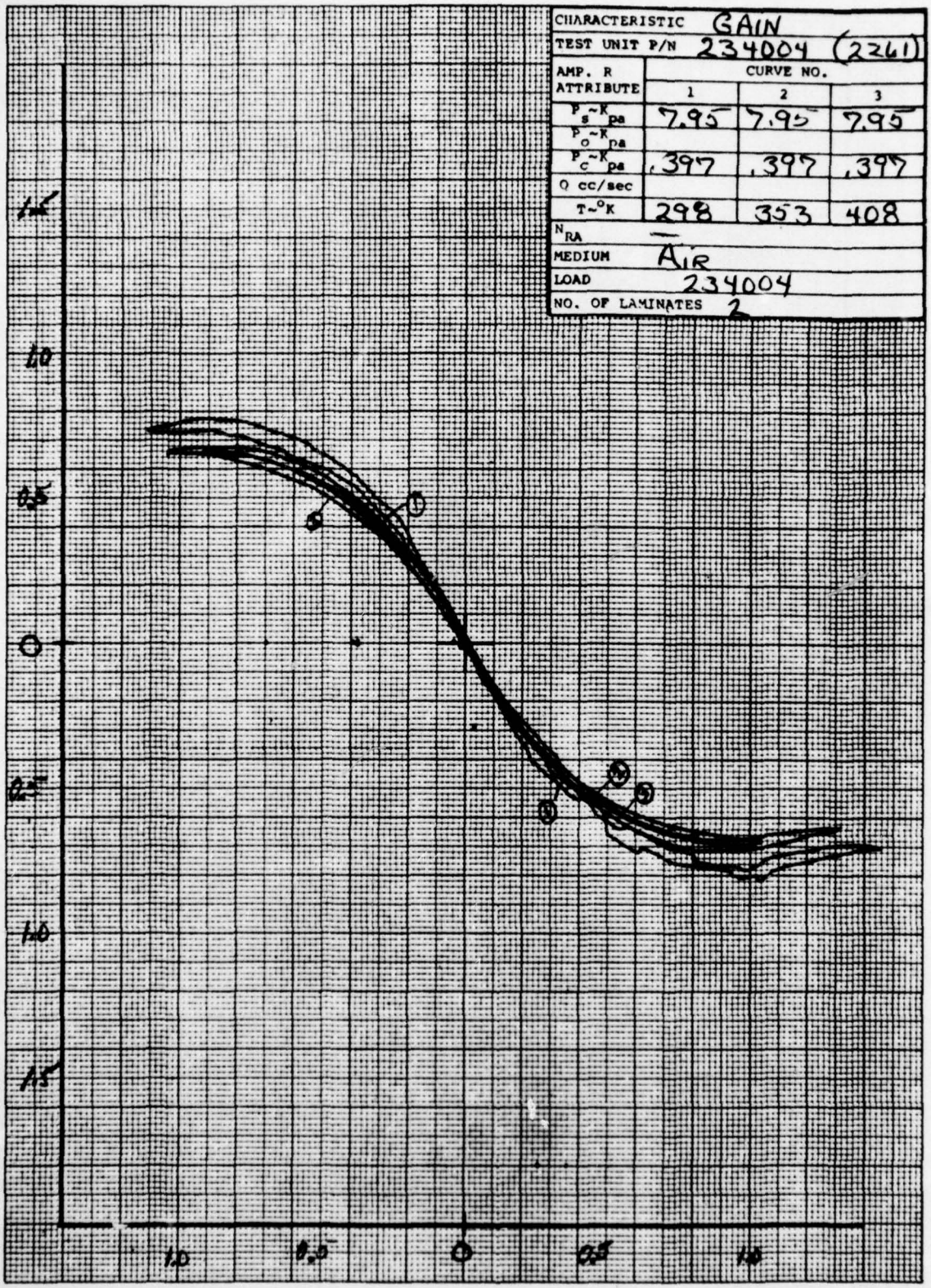

CHARACTERISTIC GAIN
TEST UNIT P/N 231004A (2260)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa
7.95
7.95
7.95
$P_o$~Kpa
$P_c$~Kpa
.397
.397
.397
Q cc/sec
T~°K
298
353
408
$N_{RA}$
MEDIUM Air
LOAD
NO. OF LAMINATES 2
7.5
5.0
2.5
0
2.5
5.0
7.5
5.0
2.5
0
2.5
5.0
$\Delta P_o$, kPa
$\Delta P_c$, kPa
1
2
3

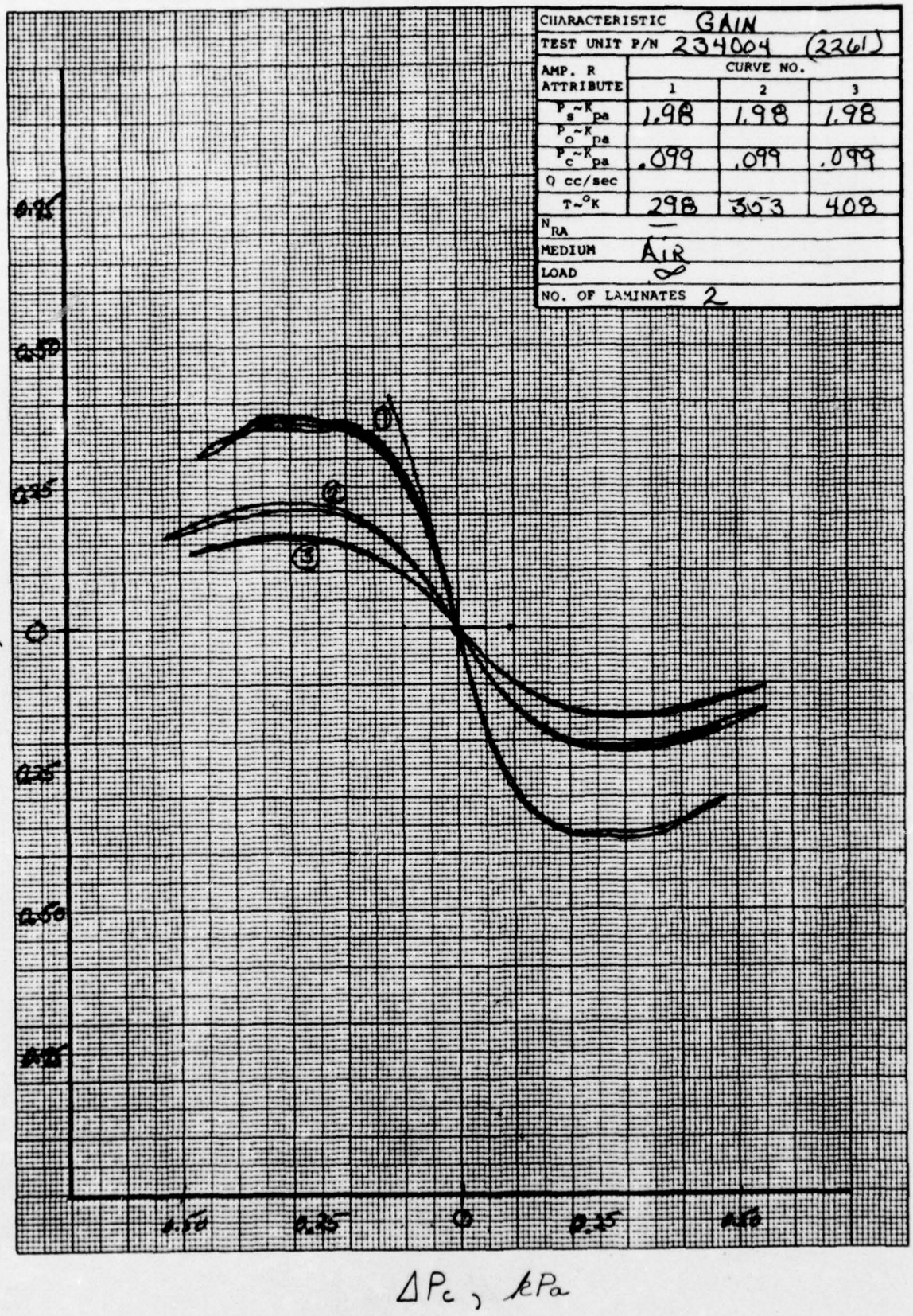

CHARACTERISTIC GAIN
TEST UNIT P/N 231004A (2260)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
7.95
7.95
7.95
$P_o$~K pa
$P_c$~K pa
.397
.397
.397
Q cc/sec
T~°K
298
353
408
$N_{RA}$ —
MEDIUM AIR
LOAD 231004A
NO. OF LAMINATES 2
3.0
2.0
1.0
0
1.0
2.0
3.0
2.0
1.0
0
1.0
2.0
$\Delta P_o$, kPa
$\Delta P_c$, kPa
3
2
1

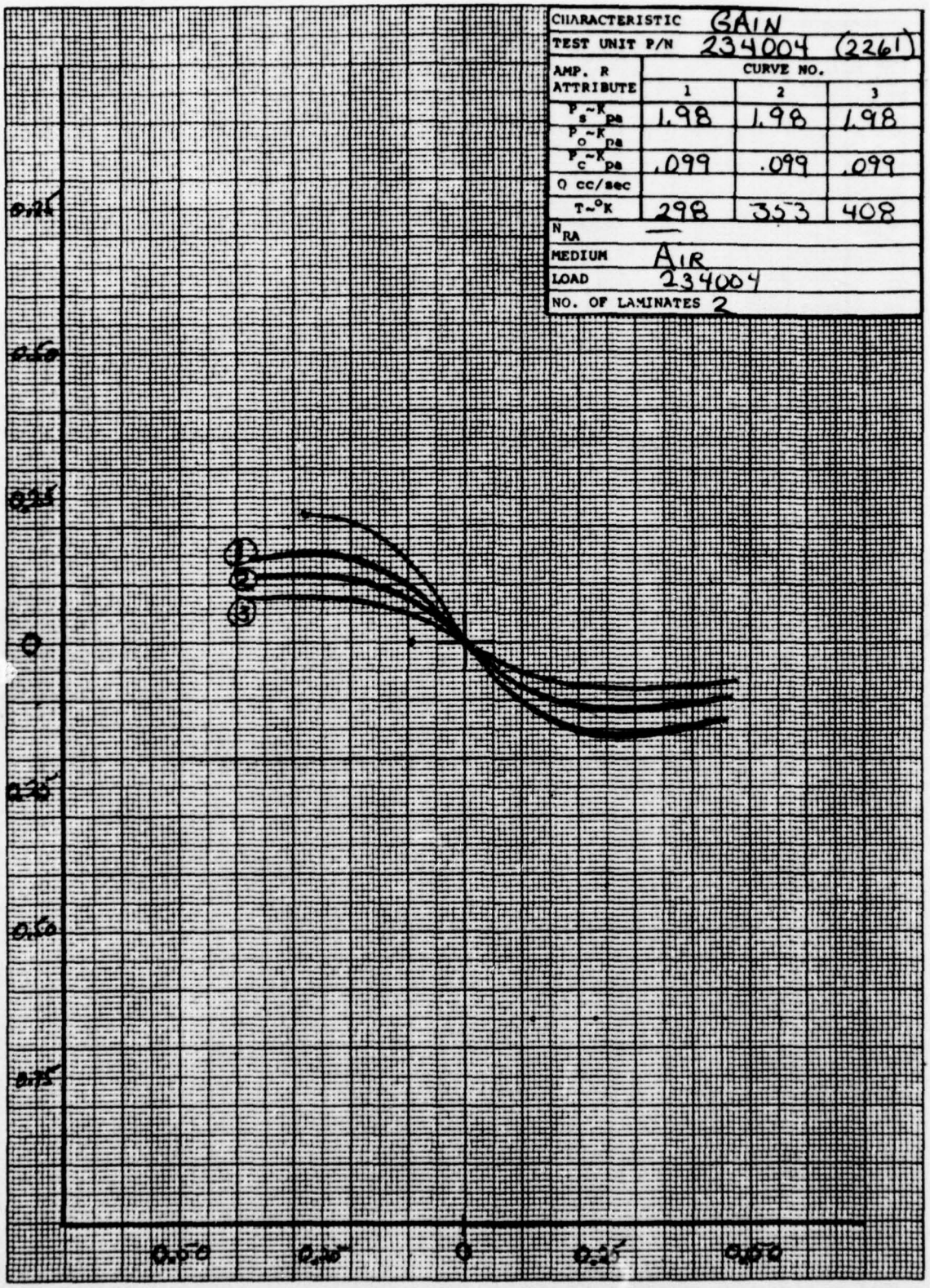

CHARACTERISTIC GAIN
TEST UNIT P/N 231004A (2260)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s \sim K_{pa}$ 1.98 1.98 1.98
$P_o \sim K_{pa}$
$P_c \sim K_{pa}$ .099 .099 .099
Q cc/sec
T~°K 298 353 408
$N_{RA}$ —
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
ΔPo, kPa
ΔPc, kPa
-50
-25
0
25
50
1
2
3

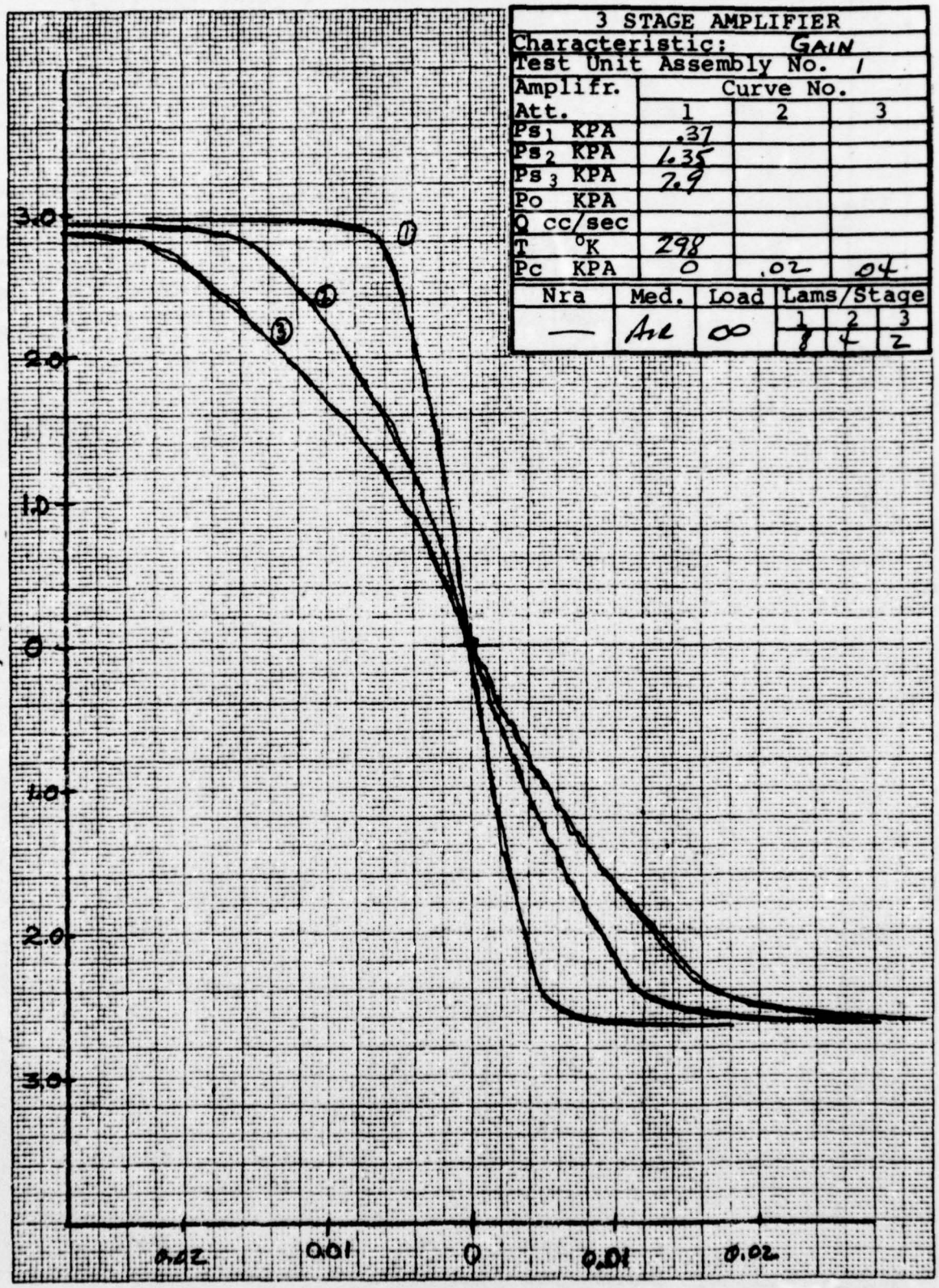

CHARACTERISTIC GAIN
TEST UNIT P/N 231004A (2260)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~$K_{pa}$ 1.98 1.98 1.98
$P_o$~$K_{pa}$
$P_c$~$K_{pa}$ .099 .099 .099
Q cc/sec
T~°K 298 353 408
$N_{RA}$ —
MEDIUM AIR
LOAD 231004A
NO. OF LAMINATES 2
0.50
0.25
0
0.25
0.50
ΔPo, kPa
ΔPc, kPa

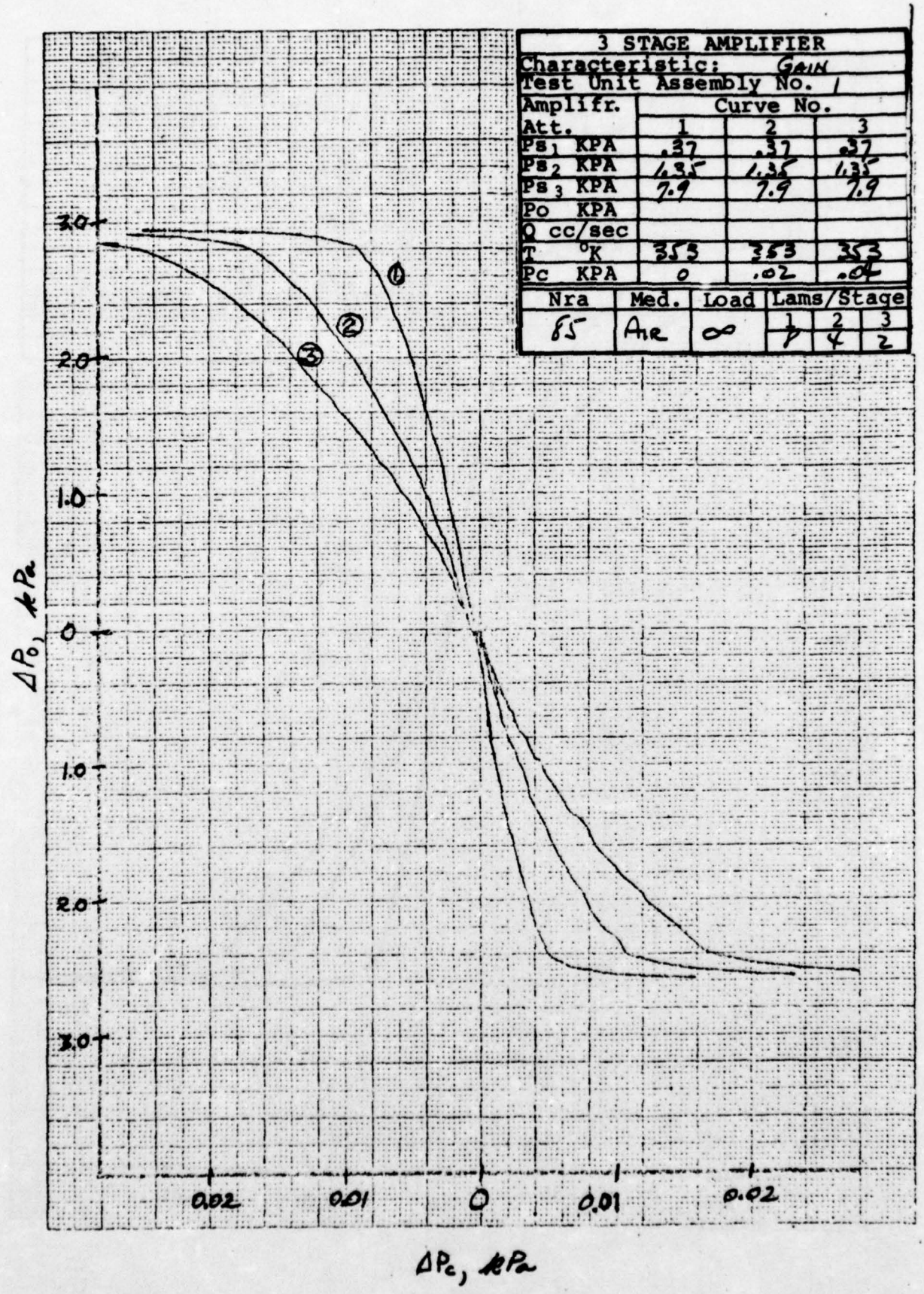

CHARACTERISTIC GAIN
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~$K_{pa}$ 7.95 7.95 7.95
$P_o$~$K_{pa}$
$P_c$~$K_{pa}$ .397 .397 .397
Q cc/sec
T~°K 298 353 408
$N_{RA}$ —
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
1.5
1.0
0.50
0
0.50
1.0
1.5
1.0
0.50
0
0.50
1.0
$\Delta P_o$, kPa
$\Delta P_c$, kPa

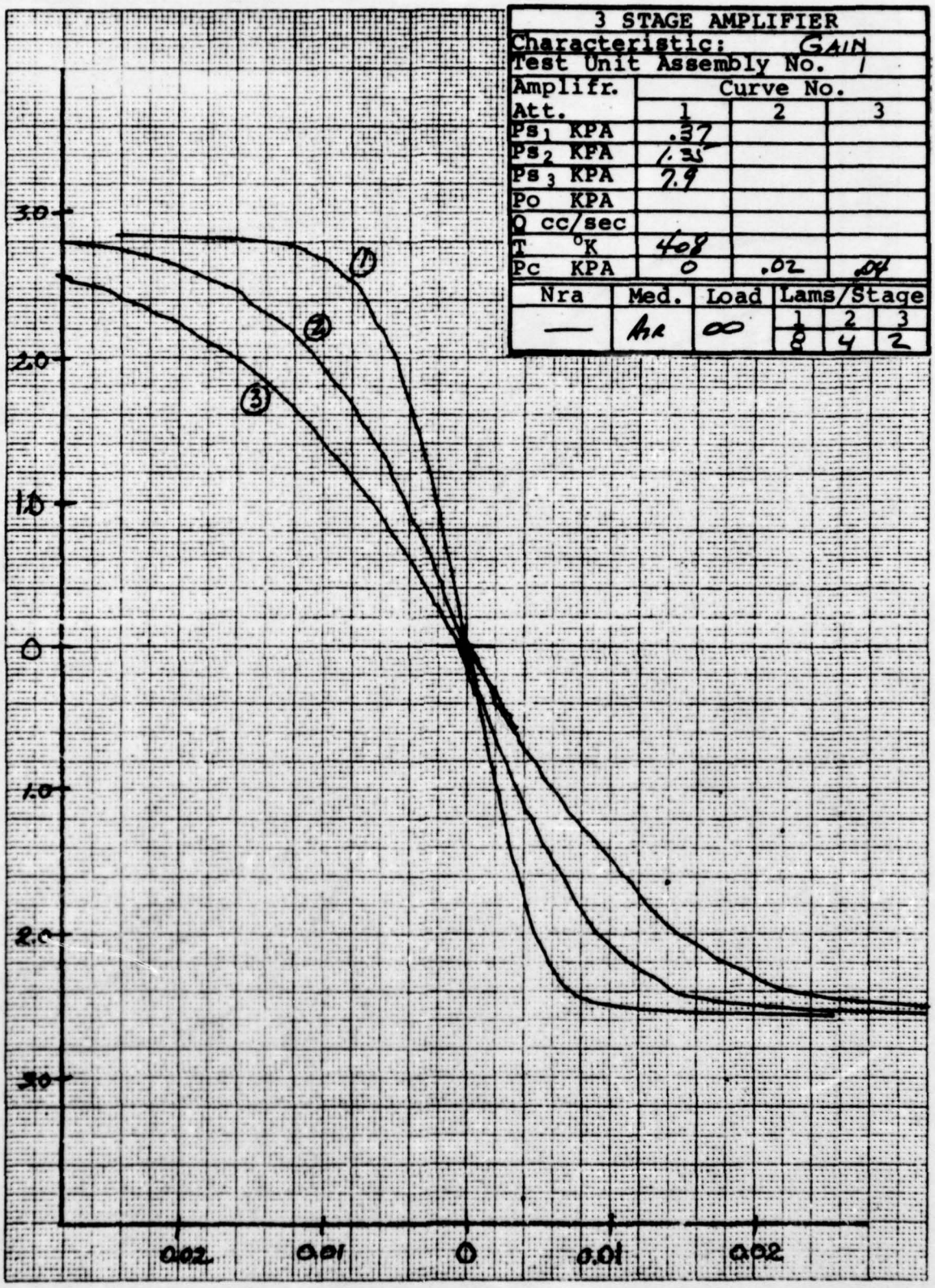

CHARACTERISTIC GAIN
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO.
1 2 3
$P_s$~K pa 7.95 7.95 7.95
$P_o$~K pa
$P_c$~K pa .397 .397 .397
Q cc/sec
T~°K 298 353 408
$N_{RA}$ —
MEDIUM AIR
LOAD 234004
NO. OF LAMINATES 2
ΔPo, kPa
ΔPc, kPa

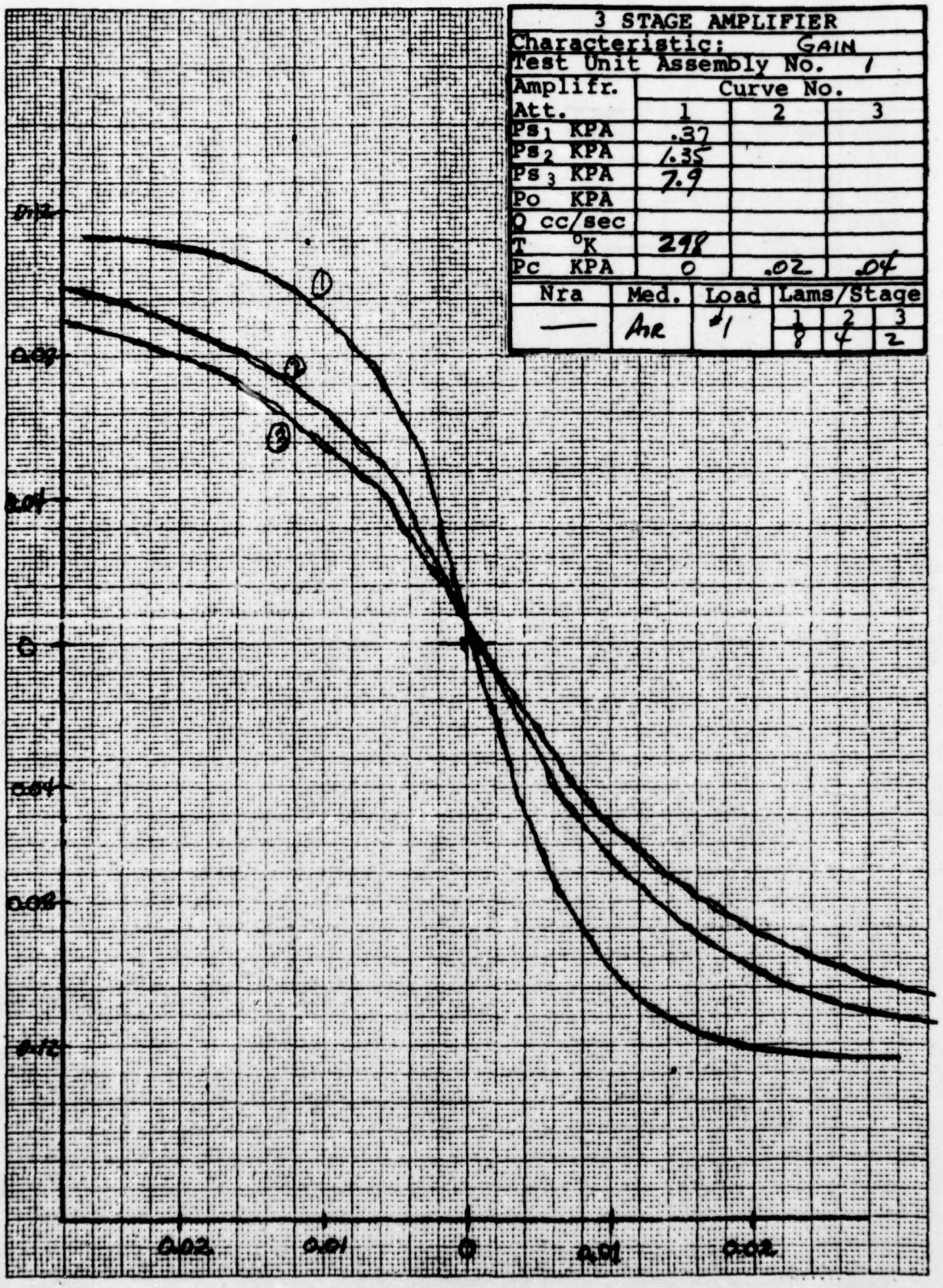

CHARACTERISTIC GAIN
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s \sim K_{pa}$ 1.98 1.98 1.98
$P_o \sim K_{pa}$
$P_c \sim K_{pa}$ .099 .099 .099
Q cc/sec
T~°K 298 353 408
$N_{RA}$
MEDIUM AIR
LOAD
NO. OF LAMINATES 2
0.75
0.50
0.25
0
0.25
0.50
0.75
0.50
0.25
0
0.25
0.50
$\Delta P_o$, kPa
$\Delta P_c$, kPa

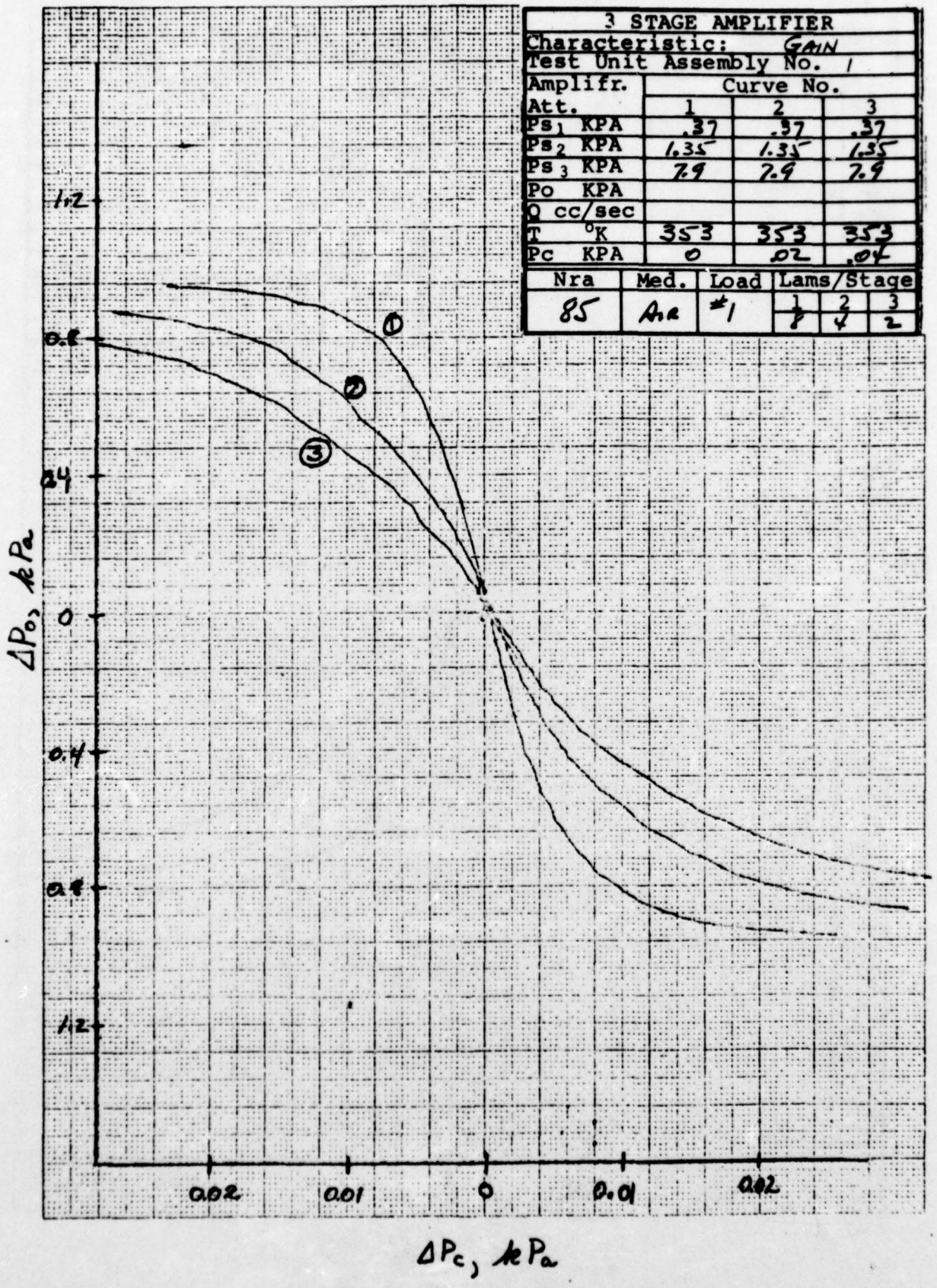

CHARACTERISTIC GAIN
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO.
1 2 3
$P_s$~K pa 1.98 1.98 1.98
$P_o$~K pa
$P_c$~K pa .099 .099 .099
Q cc/sec
T~°K 298 353 408
$N_{RA}$ —
MEDIUM AIR
LOAD 234004
NO. OF LAMINATES 2
0.25
0.50
0.25
0
0.25
0.50
0.75
0.50
0.25
0
0.25
0.50
ΔPo, kPa
ΔPc, kPa

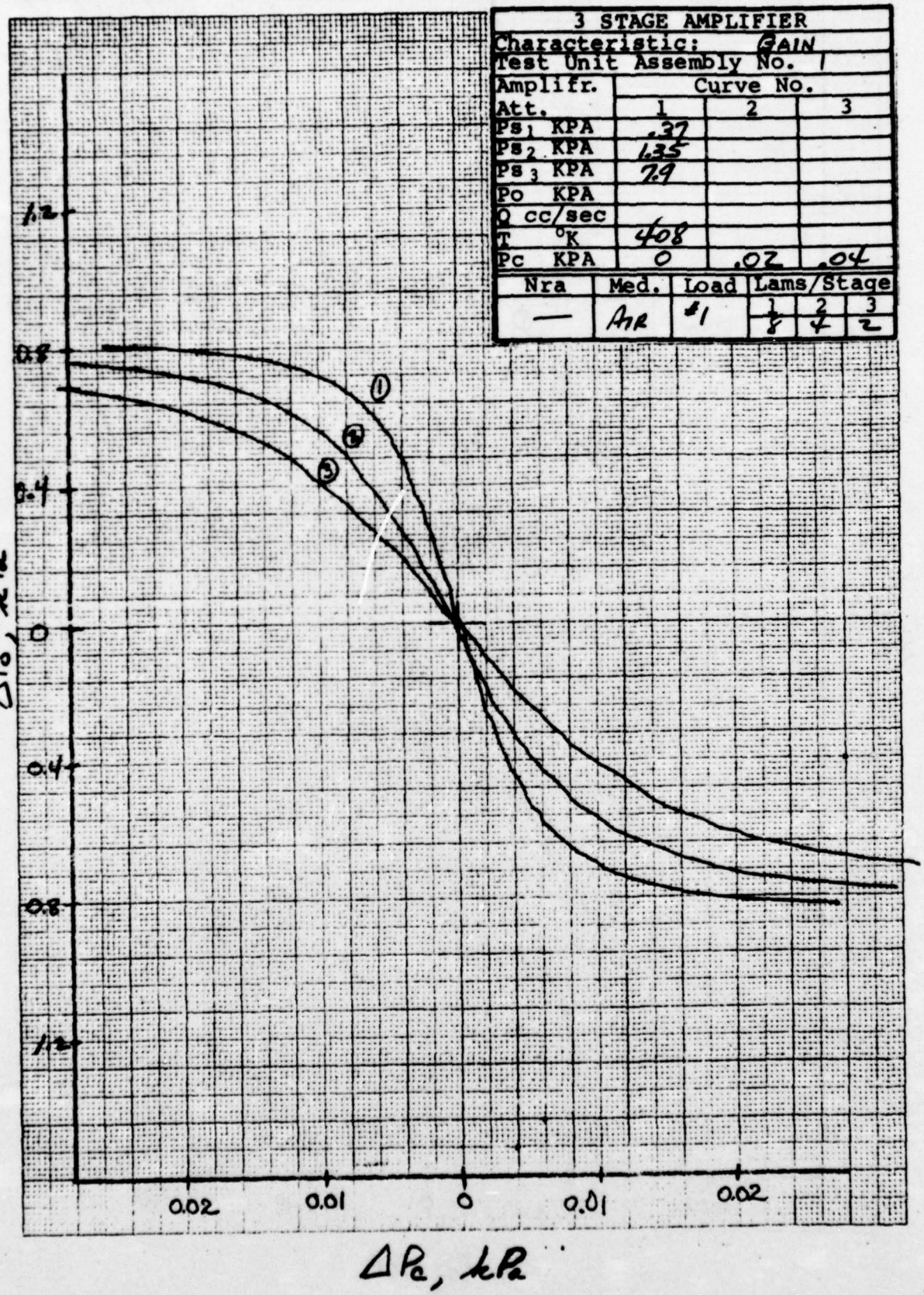

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 1
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .37
Ps2 KPA 1.35
Ps3 KPA 2.9
Po KPA
Q cc/sec
T °K 298
Pc KPA 0 .02 .04
Nra — Med. Air Load ∞ Lams/Stage 1 8 2 4 3 2
3.0
2.0
1.0
0
1.0
2.0
3.0
0.02
0.01
0
0.01
0.02
ΔPo, kPa
ΔPc, kPa

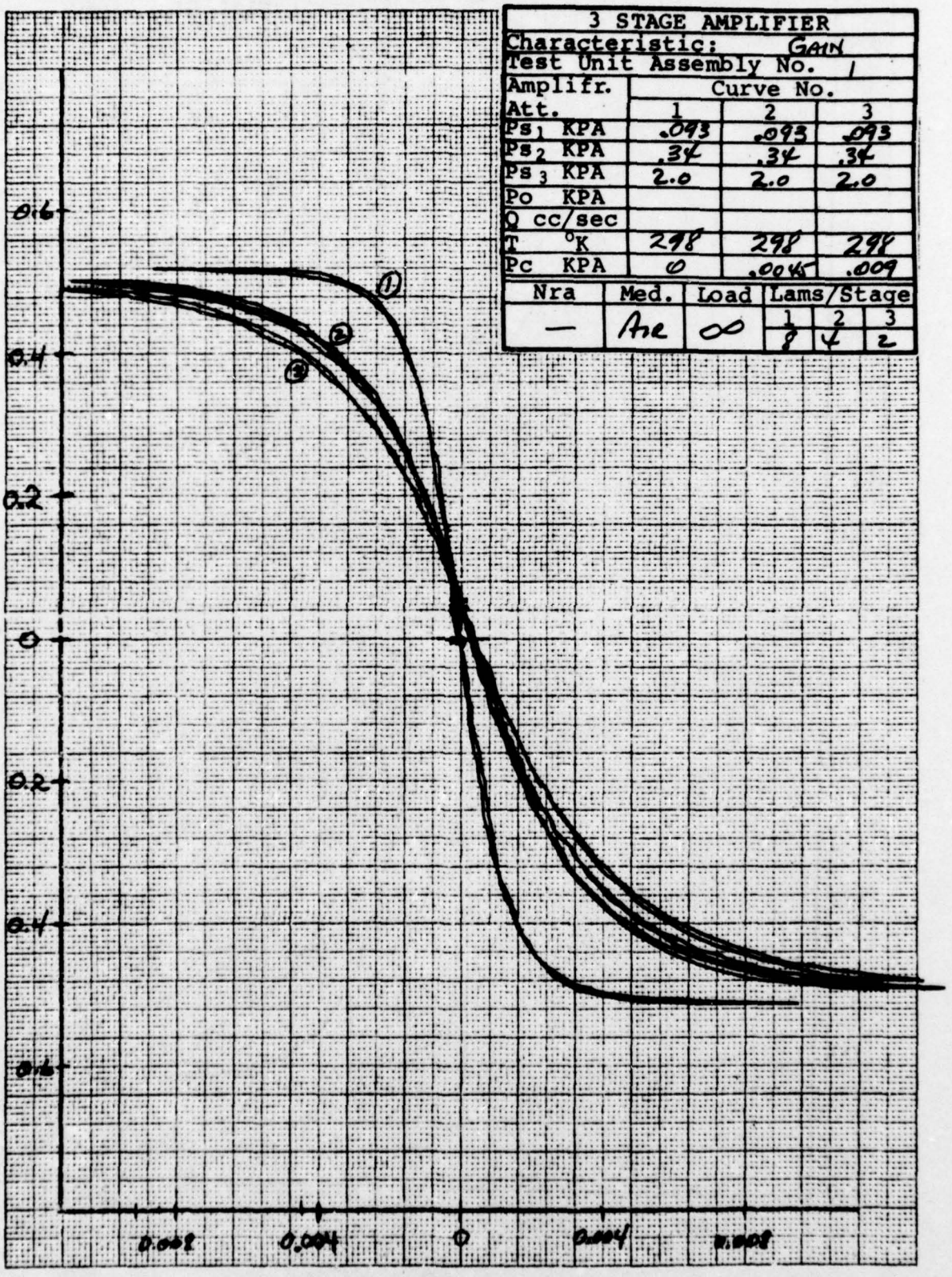

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 1
Amplifr. Curve No.
Att. 1 2 3
Ps1 KPA .37 .37 .37
Ps2 KPA 1.35 1.35 1.35
Ps3 KPA 7.9 7.9 7.9
Po KPA
Q cc/sec
T °K 353 353 353
Pc KPA 0 .02 .04
Nra Med. Load Lams/Stage
85 Air ∞ 1 2 3
1 4 2
3.0
2.0
1.0
0
1.0
2.0
3.0
0.02
0.01
0
0.01
0.02
ΔPo, kPa
ΔPc, kPa
①
②
③


3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 1
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .37
Ps2 KPA 1.31
Ps3 KPA 7.9
Po KPA
Q cc/sec
T °K 408
Pc KPA 0 .02 .04
Nra — Med. Air Load ∞ Lams/Stage 1/8 2/4 3/2
3.0
2.0
1.0
0
1.0
2.0
3.0
0.02
0.01
0
0.01
0.02
ΔPo, kPa
ΔPc, kPa
1
2
3


3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 1
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .37
Ps2 KPA 1.35
Ps3 KPA 7.9
Po KPA
Q cc/sec
T °K 298
Pc KPA 0 .02 .04
Nra — Med. Air Load #1 Lams/Stage 1/8 2/4 3/2
0.02
0.01
0
0.01
0.02
ΔPo, kPa
ΔPc, kPa

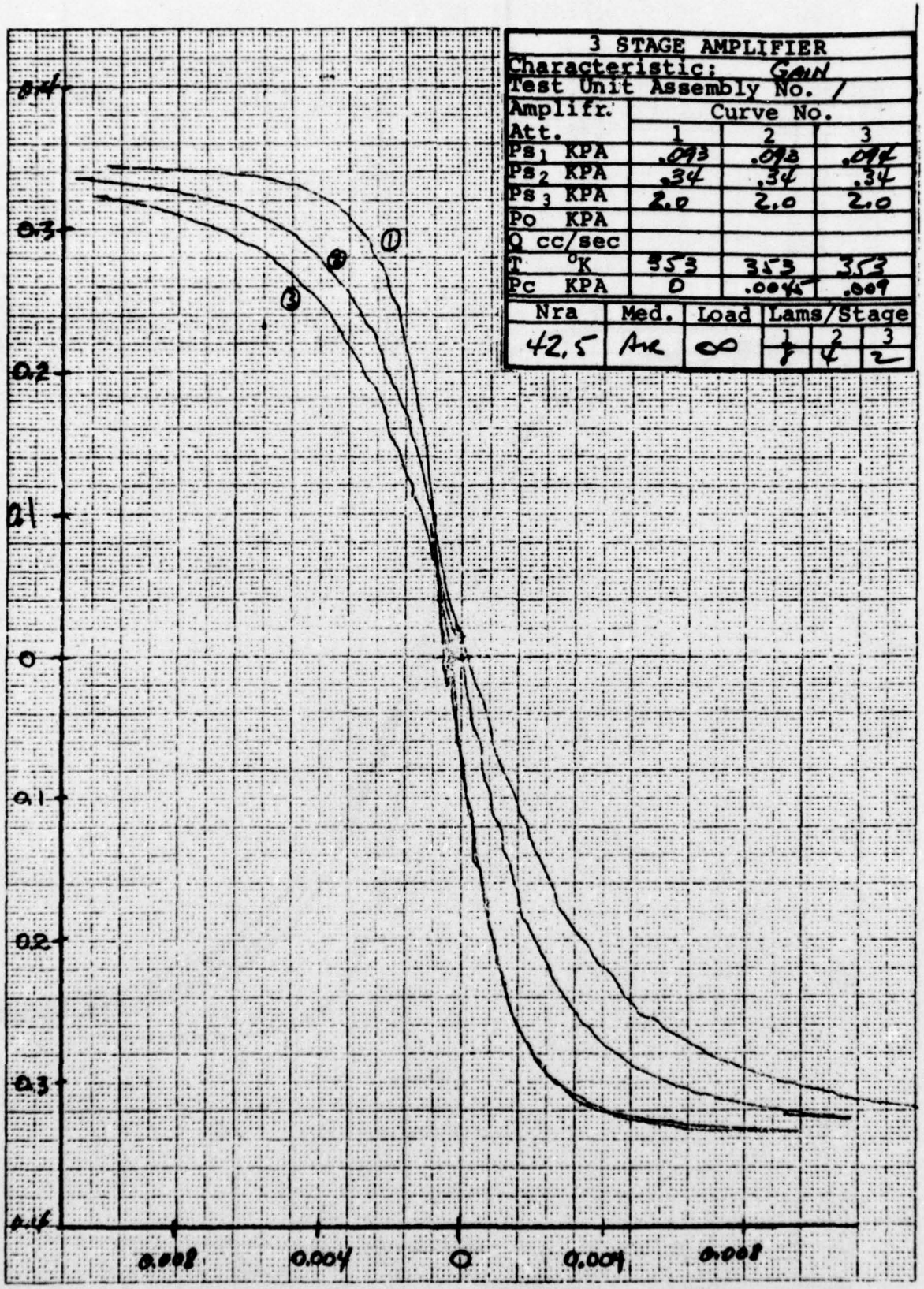

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 1
Amplifr. | Curve No. | 1 | 2 | 3
Att. | | | |
Ps1 KPA | .37 | .37 | .37
Ps2 KPA | 1.35 | 1.35 | 1.35
Ps3 KPA | 7.9 | 7.9 | 7.9
Po KPA | | | |
Q cc/sec | | | |
T °K | 353 | 353 | 353
Pc KPA | 0 | .02 | .04
Nra | Med. | Load | Lams/Stage | 1 | 2 | 3
85 | Air | #1 | | 1/8 | 2/4 | 3/2
1.2
0.8
0.4
0
0.4
1.2
ΔPo, kPa
0.02
0.01
0
0.01
0.02
ΔPc, kPa
①
②
③

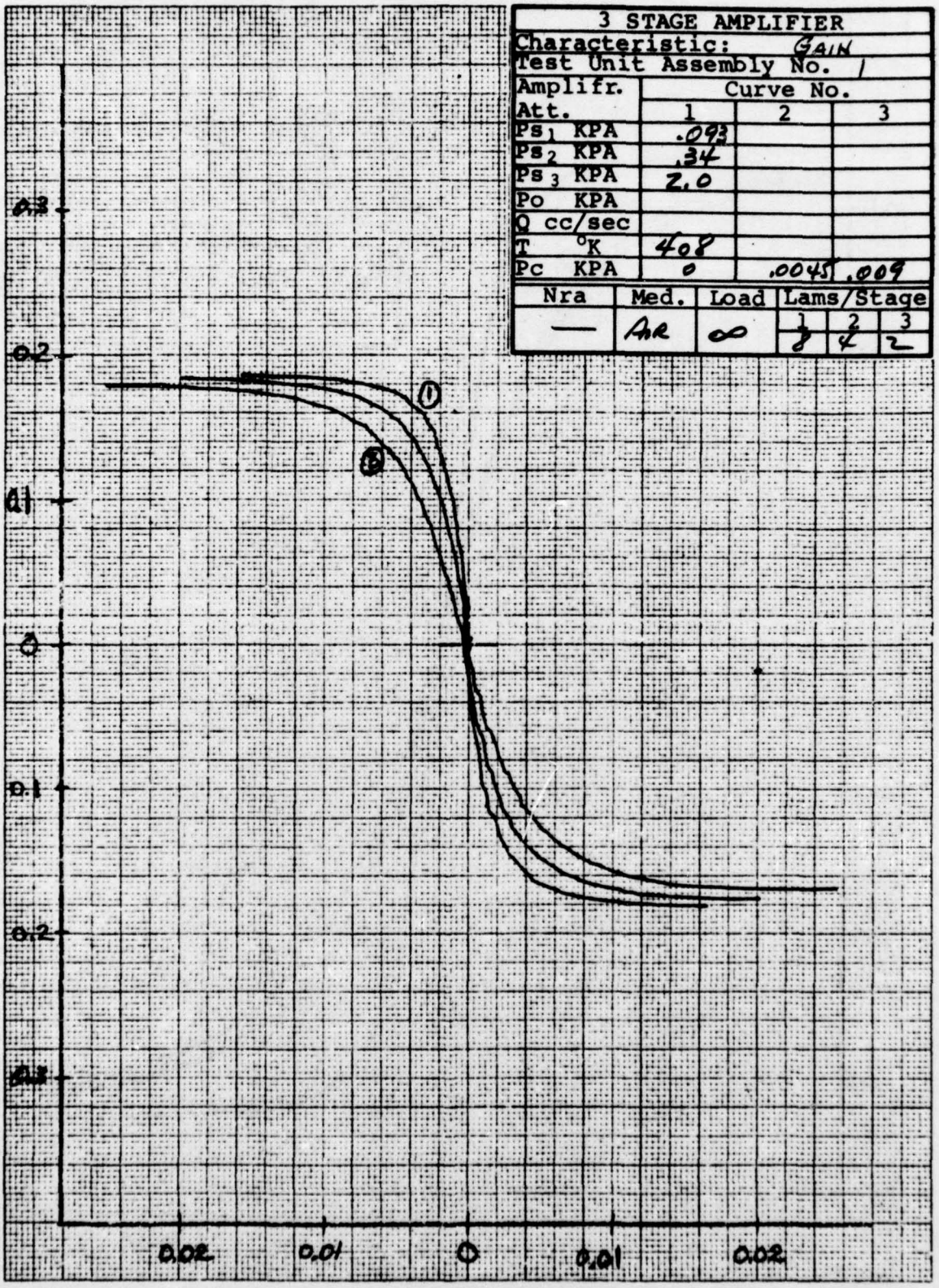

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 1
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .37
Ps2 KPA 1.35
Ps3 KPA 7.9
Po KPA
Q cc/sec
T °K 408
Pc KPA 0 .02 .04
Nra — Med. Air Load #1 Lams/Stage 1 2 3 1/8 1/4 1/2
1.2
0.8
0.4
0
0.4
0.8
1.2
ΔPo, kPa
0.02
0.01
0
0.01
0.02
ΔPc, kPa

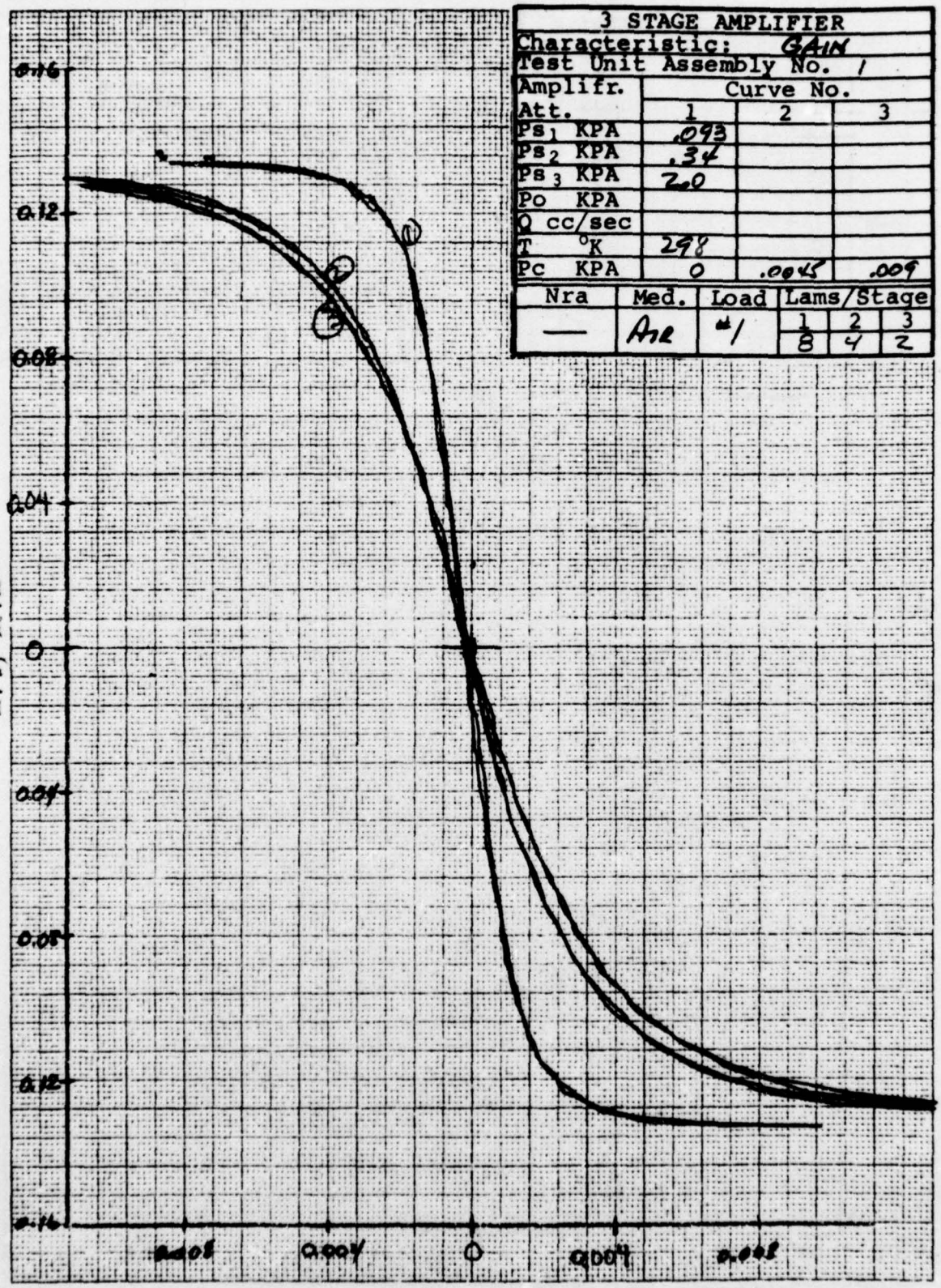


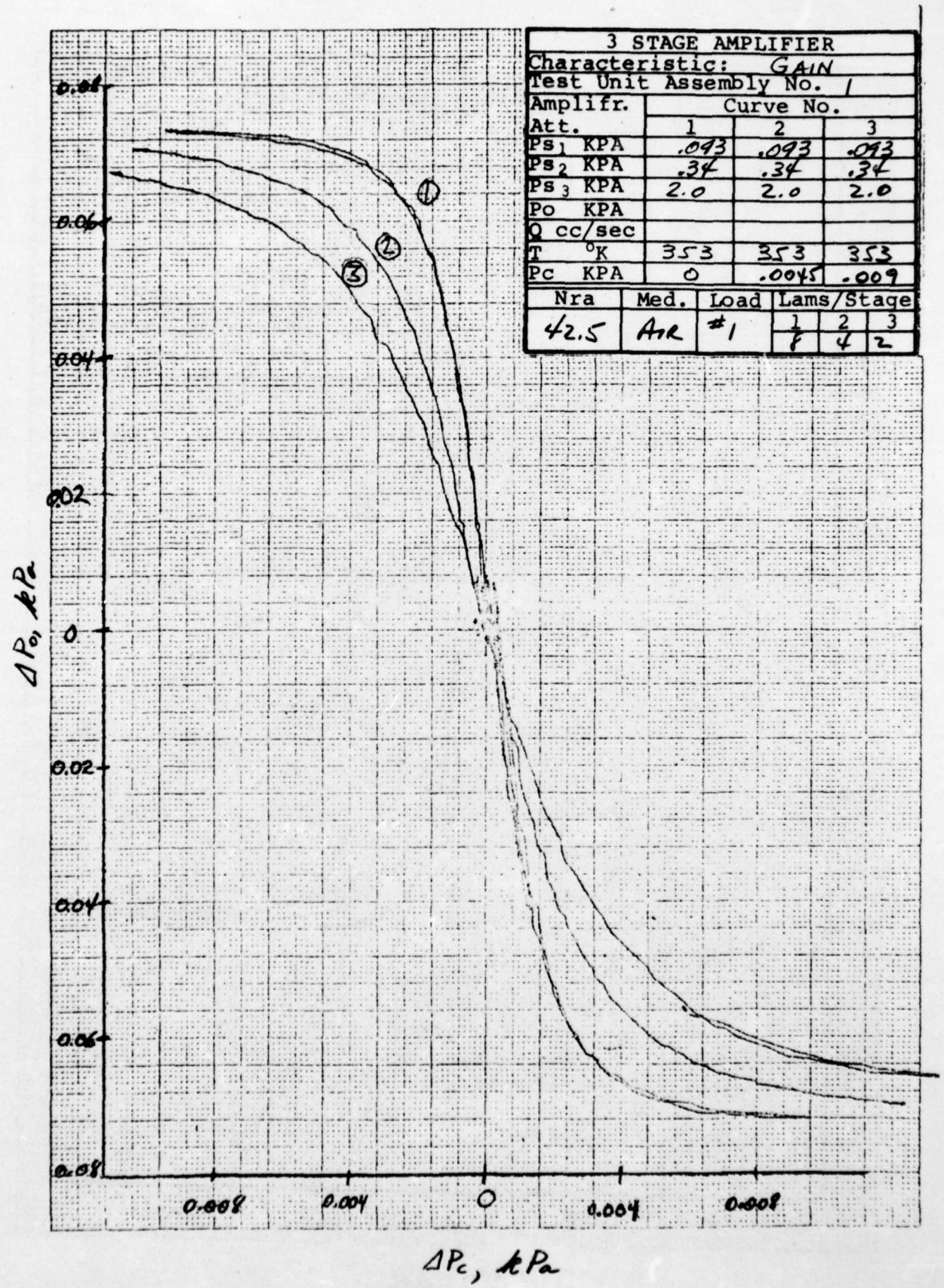

| 3 STAGE AMPLIFIER | | | |
|---|---|---|---|
| Characteristic: GAIN | | | |
| Test Unit Assembly No. 1 | | | |
| Amplifr. Att. | Curve No. 1 | Curve No. 2 | Curve No. 3 |
| $Ps_1$ KPA | .093 | .093 | .093 |
| $Ps_2$ KPA | .34 | .34 | .34 |
| $Ps_3$ KPA | 2.0 | 2.0 | 2.0 |
| Po KPA | | | |
| Q cc/sec | | | |
| T °K | 298 | 298 | 298 |
| Pc KPA | 0 | .0045 | .009 |

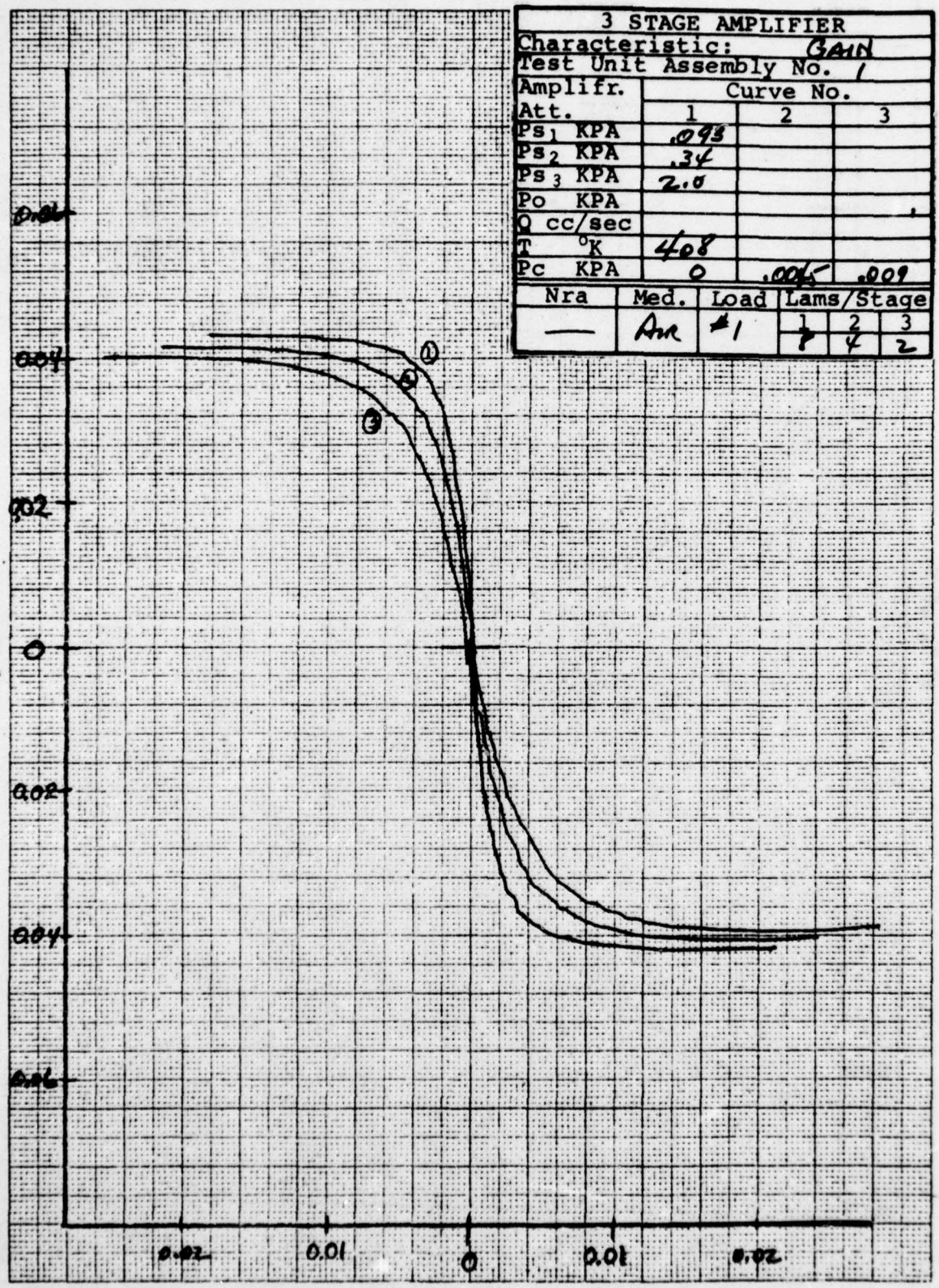
| Nra | Med. | Load | Lams/Stage 1 | 2 | 3 |
|---|---|---|---|---|---|
| — | Air | ∞ | 8 | 4 | 2 |

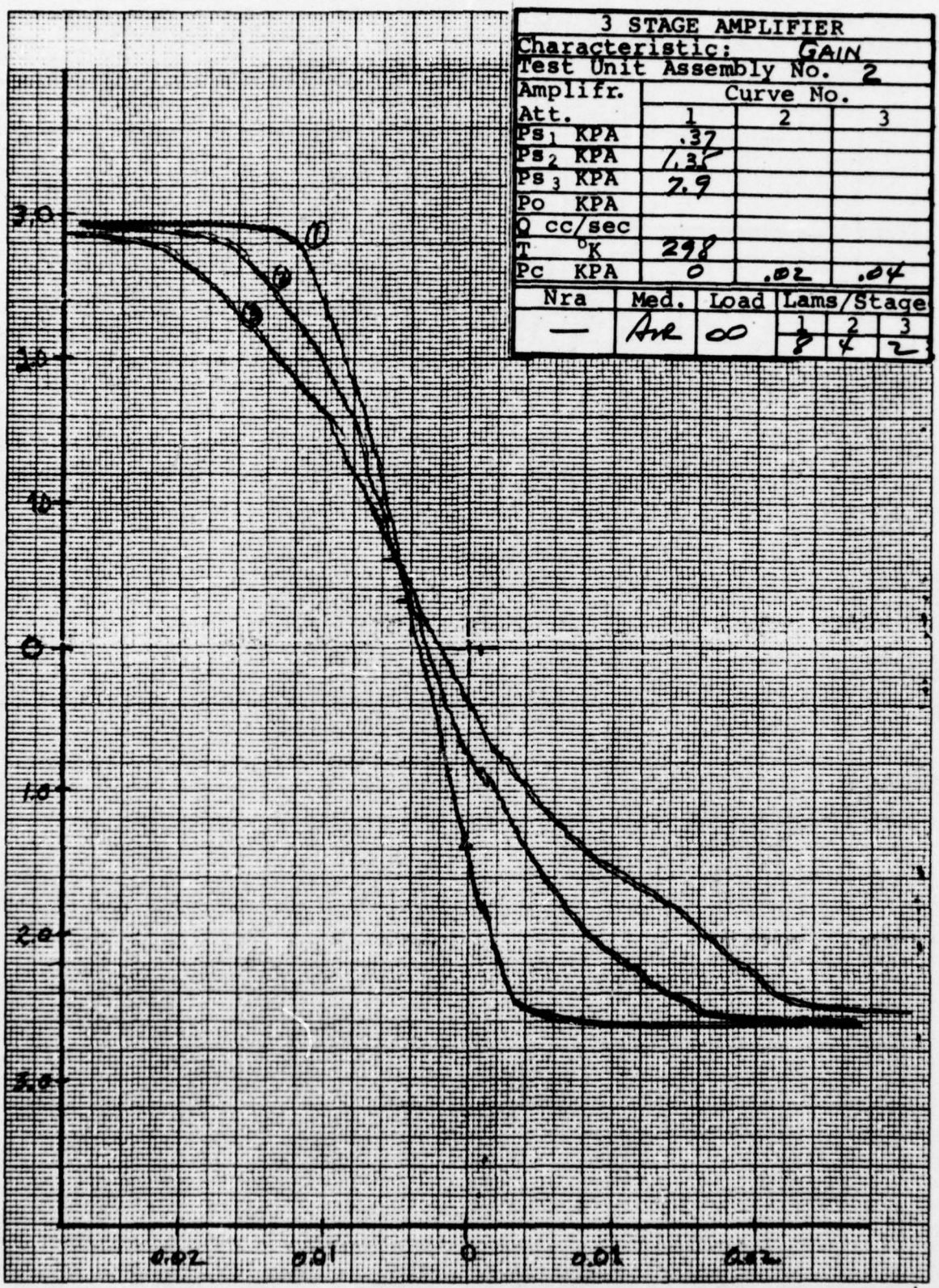

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 1
Amplifr. Att. | Curve No. 1 | 2 | 3
Ps1 KPA | .093 | .093 | .093
Ps2 KPA | .34 | .34 | .34
Ps3 KPA | 2.0 | 2.0 | 2.0
Po KPA | | | |
Q cc/sec | | | |
T °K | 353 | 353 | 353
Pc KPA | 0 | .0045 | .009
Nra | Med. | Load | Lams/Stage 1 | 2 | 3
42.5 | Air | ∞ | 1 | 4 | 2
0.4
0.3
0.2
0.1
0
0.1
0.2
0.3
0.4
0.008
0.004
0
0.004
0.008
ΔPo, kPa
ΔPc, kPa
1
2
3

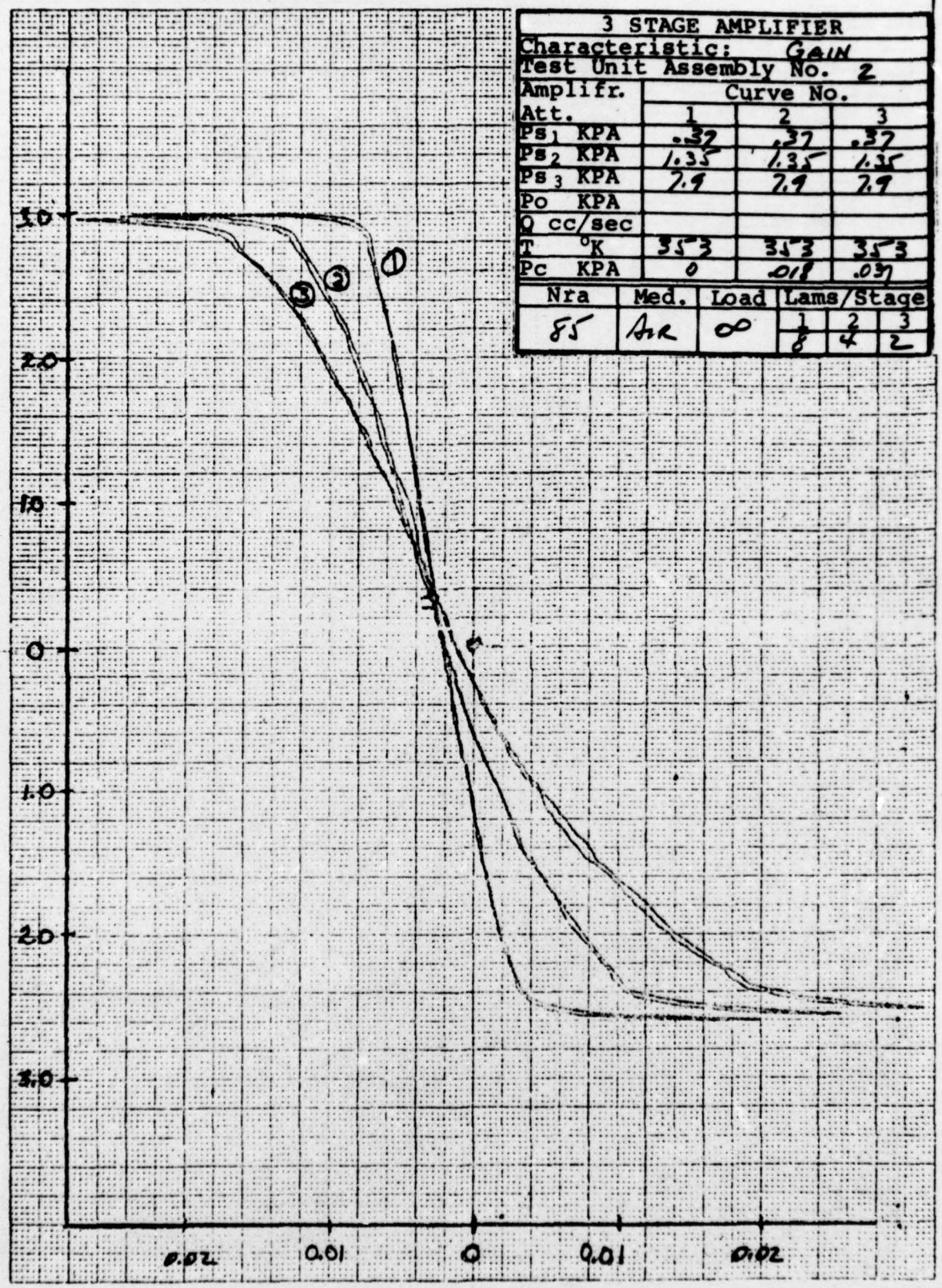

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 1
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .093
Ps2 KPA .34
Ps3 KPA 2.0
Po KPA
Q cc/sec
T °K 408
Pc KPA 0 .0045 .009
Nra — Med. Air Load ∞ Lams/Stage 1 8 2 4 3 2
0.3
0.2
0.1
0
0.1
0.2
0.3
ΔPo, kPa
0.02
0.01
0
0.01
0.02
ΔPc, kPa
1
2

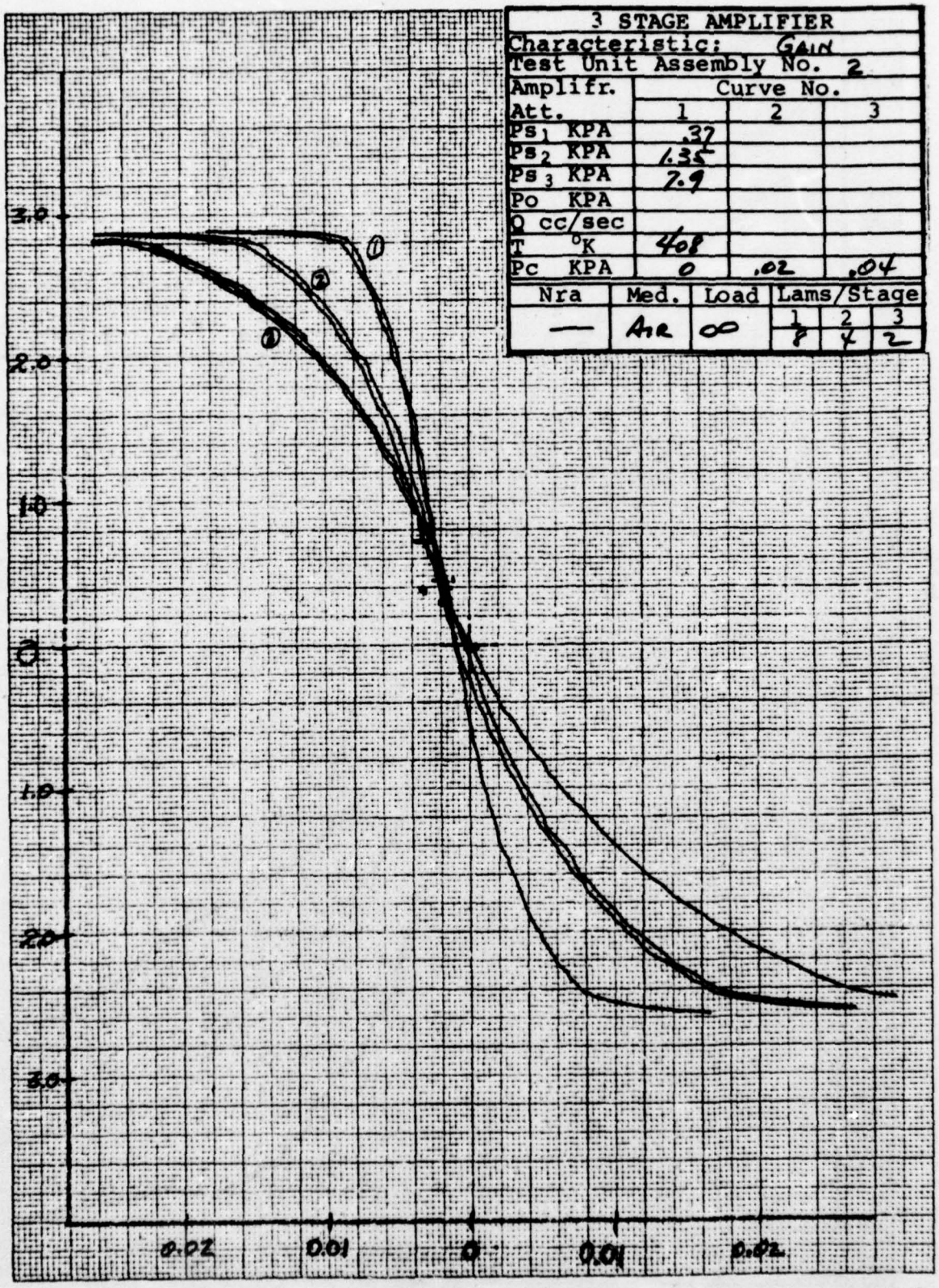

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 1
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .093
Ps2 KPA .34
Ps3 KPA 2.0
Po KPA
Q cc/sec
T °K 298
Pc KPA 0 .0045 .009
Nra — Med. Air Load #1 Lams/Stage 1/8 2/4 3/2
0.16
0.12
0.08
0.04
0
0.04
0.08
0.12
0.16
ΔKo, kPa
-0.008
-0.004
0
0.004
0.008
ΔPc, kPa

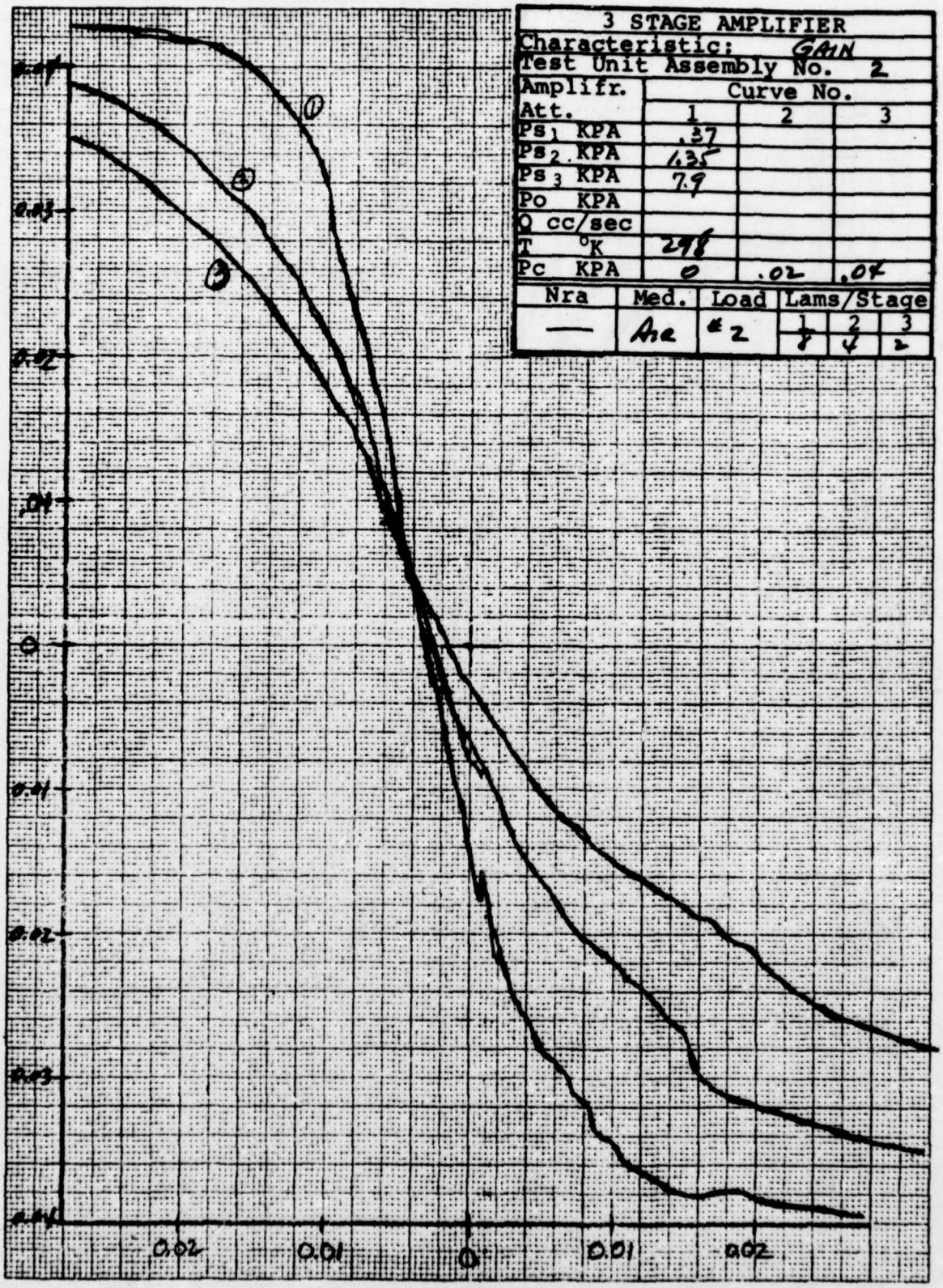

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 1
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .093 .093 .093
Ps2 KPA .34 .34 .34
Ps3 KPA 2.0 2.0 2.0
Po KPA
Q cc/sec
T °K 353 353 353
Pc KPA 0 .0045 .009
Nra 42.5
Med. Air
Load #1
Lams/Stage 1 2 3 / 1 4 2
0.08
0.06
0.04
0.02
0
0.02
0.04
0.06
0.08
ΔPo, kPa
0.008
0.004
0
0.004
0.008
ΔPc, kPa
1
2
3

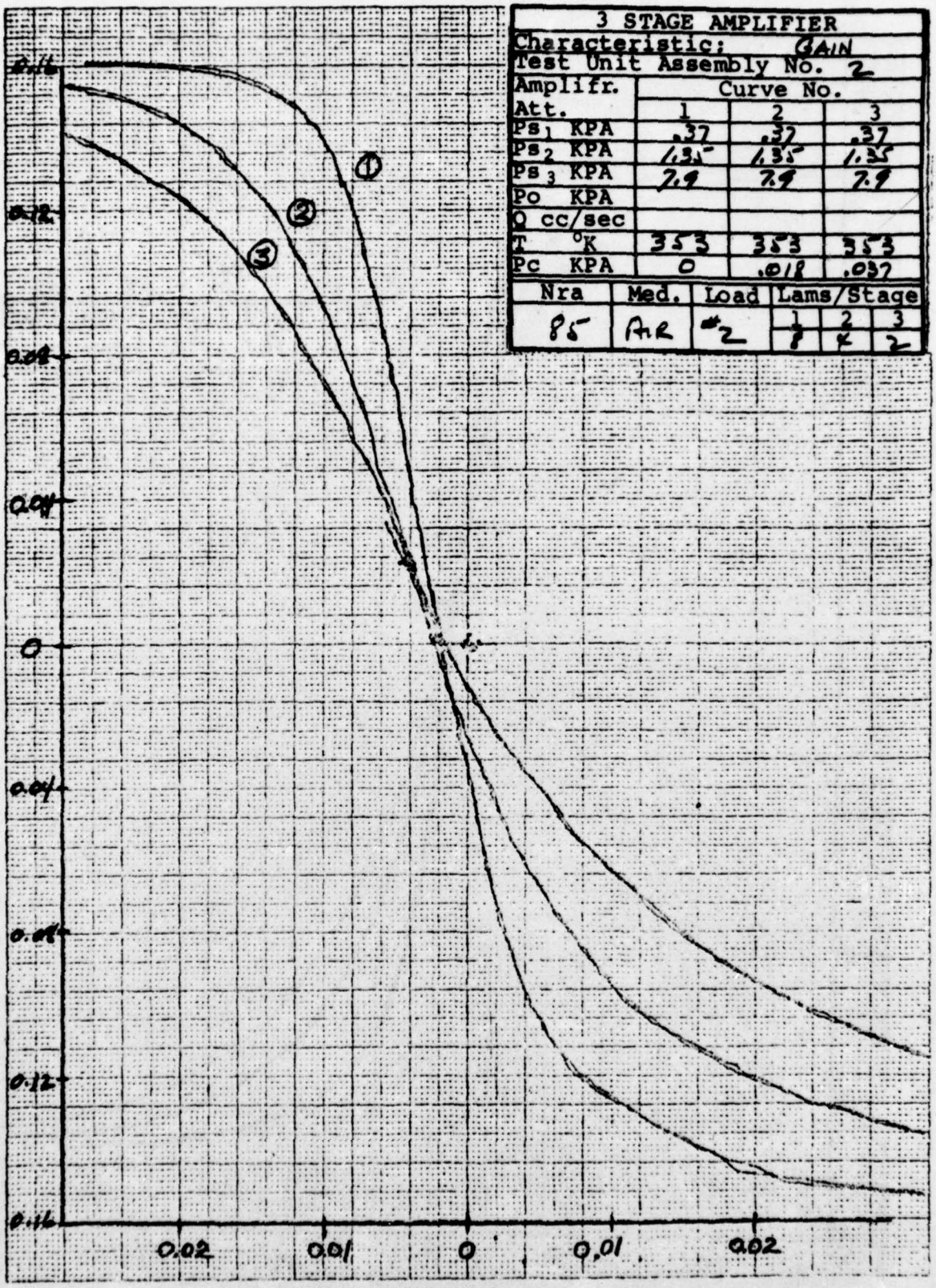

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 1
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .093
Ps2 KPA .34
Ps3 KPA 2.0
Po KPA
Q cc/sec
T °K 408
Pc KPA 0 .005 .009
Nra — Med. Amr Load #1 Lams/Stage 1 2 3 7 4 2
0.04
0.02
0
0.02
0.04
ΔPo, kPa
0.02
0.01
0
0.01
0.02
ΔPc, kPa

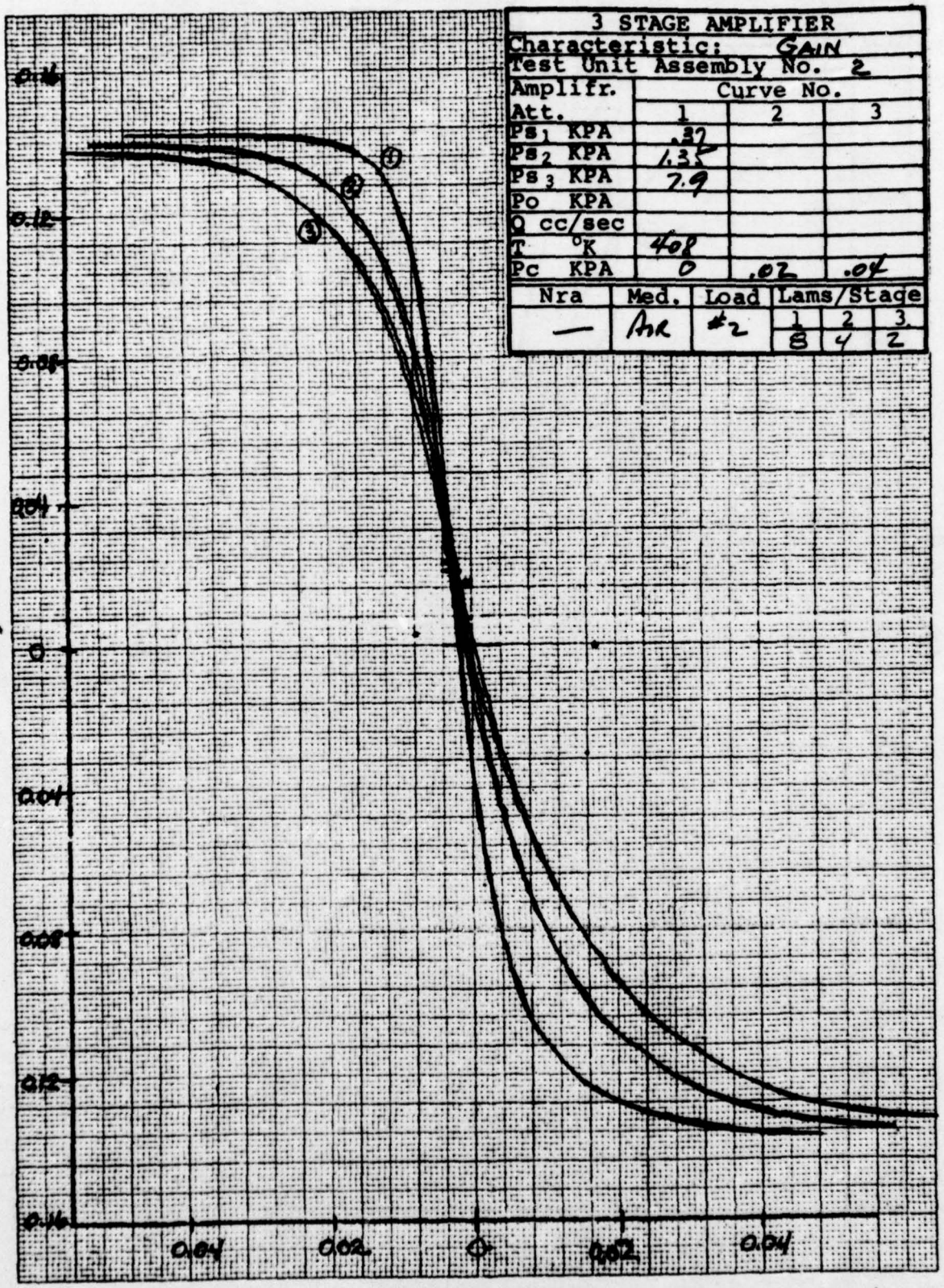

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 2
Amplifr. Curve No.
Att. 1 2 3
Ps1 KPA .37
Ps2 KPA 1.3
Ps3 KPA 2.9
Po KPA
Q cc/sec
T °K 298
Pc KPA 0 .02 .04
Nra Med. Load Lams/Stage
— Air ∞ 1/8 2/4 3/2
3.0
2.0
1.0
0
1.0
2.0
3.0
0.02
0.01
0
0.01
0.02
ΔPo, kPa
ΔPc, kPa

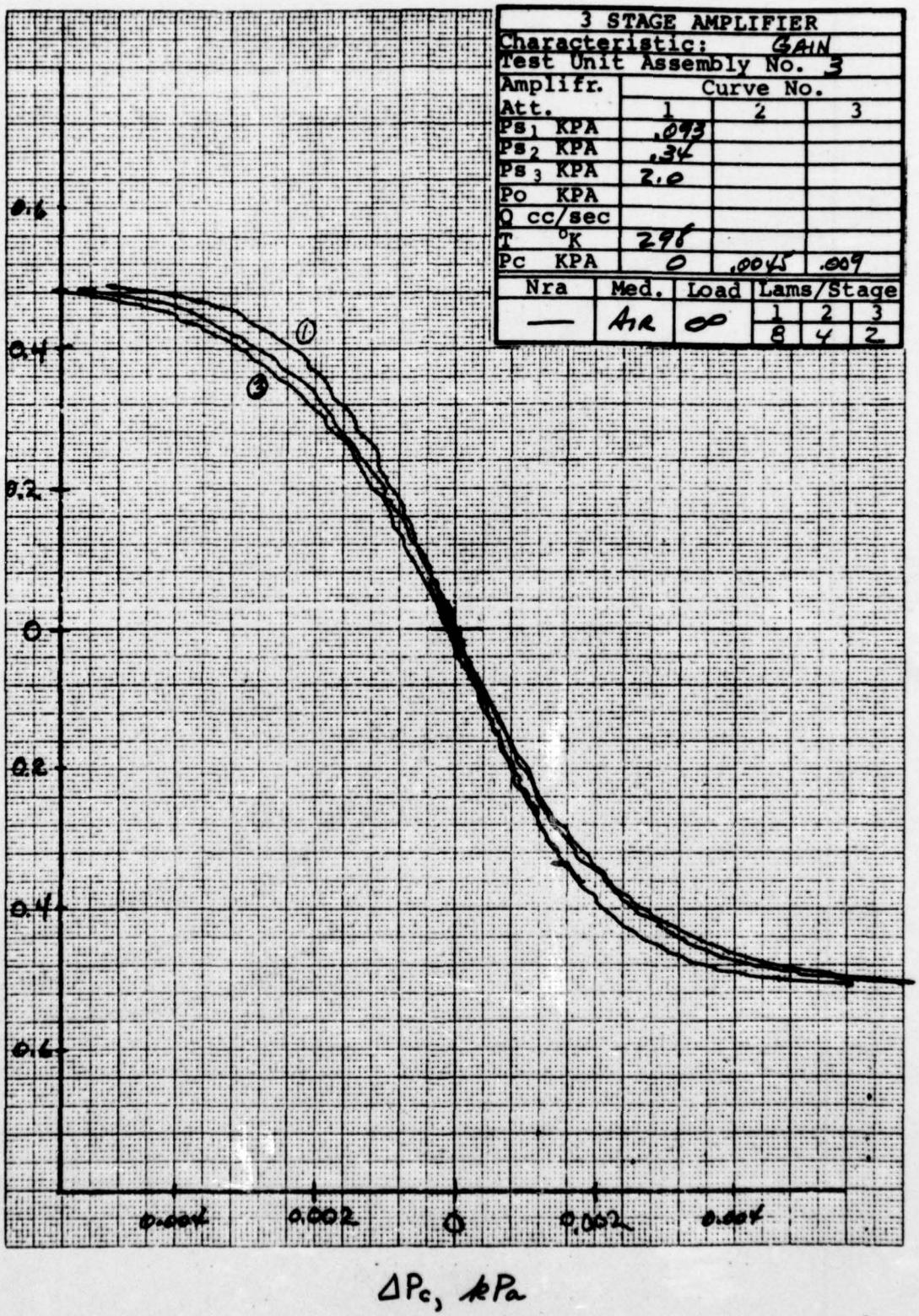

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 2
Amplifr. Att. | Curve No. 1 | 2 | 3
Ps1 KPA | .37 | .37 | .37
Ps2 KPA | 1.35 | 1.35 | 1.35
Ps3 KPA | 7.9 | 7.9 | 7.9
Po KPA | | |
Q cc/sec | | |
T °K | 353 | 353 | 353
Pc KPA | 0 | .018 | .037
Nra | Med. | Load | Lams/Stage 1 | 2 | 3
85 | Air | ∞ | 1/8 | 2/4 | 3/2
3.0
2.0
1.0
0
1.0
2.0
3.0
ΔPo, kPa
0.02
0.01
0
0.01
0.02
ΔPc, kPa

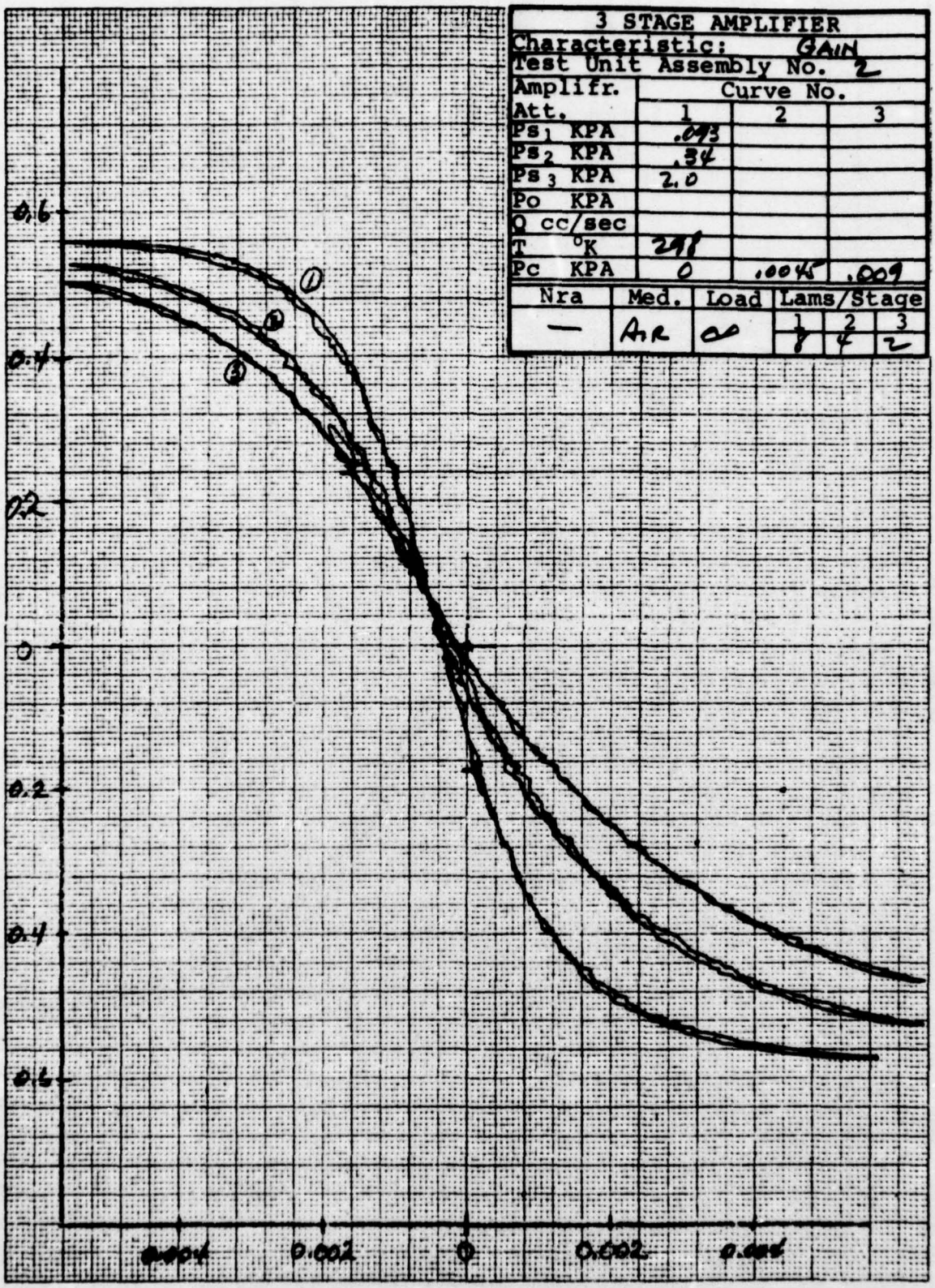

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 2
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .37
Ps2 KPA 1.35
Ps3 KPA 7.9
Po KPA
Q cc/sec
T °K 408
Pc KPA 0 .02 .04
Nra — Med. Air Load ∞ Lams/Stage 1 8 2 4 3 2
3.0
2.0
1.0
0
1.0
2.0
3.0
0.02
0.01
0
0.01
0.02
ΔPo, kPa
ΔPc, kPa

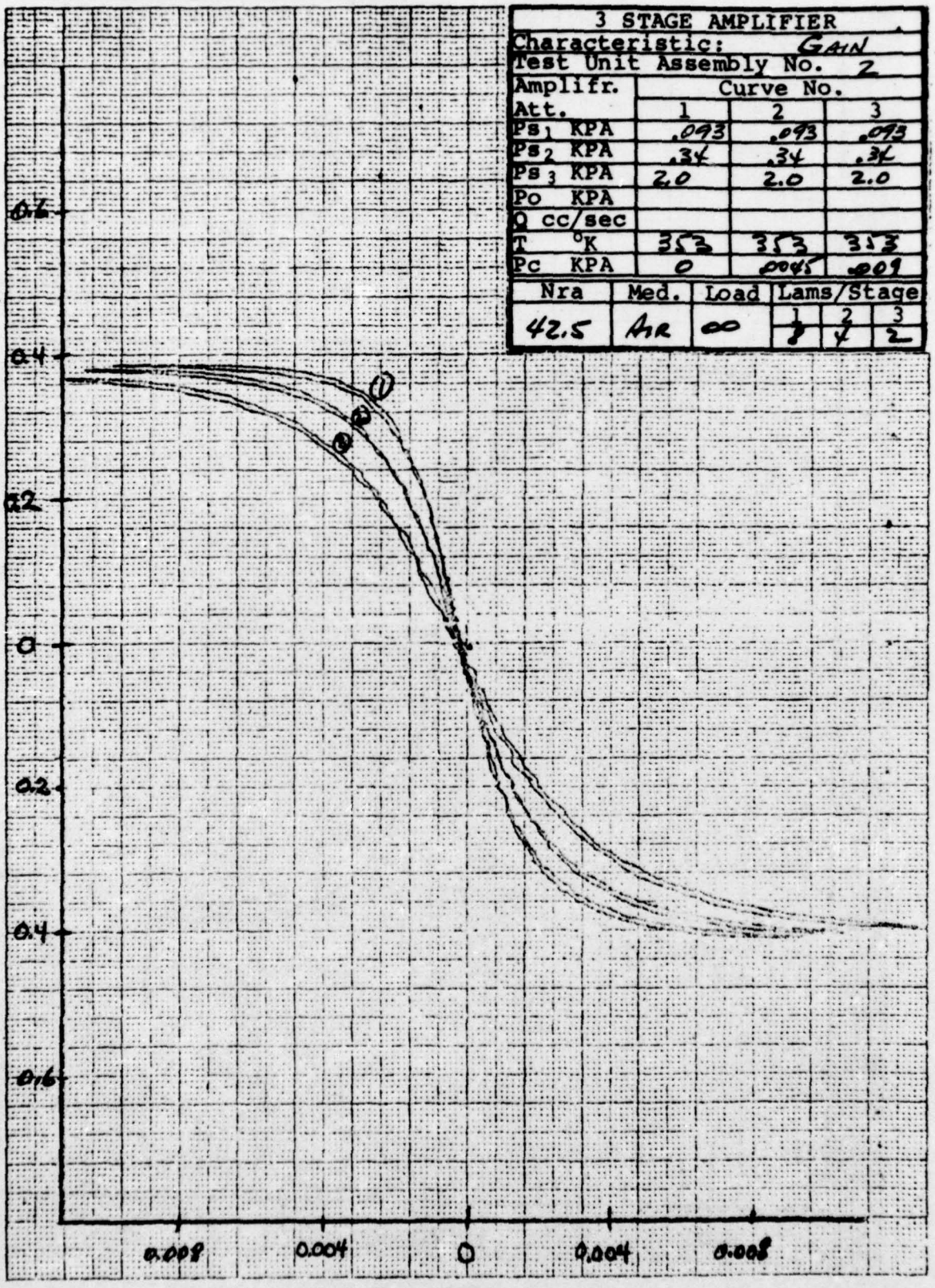

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 2
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .37
Ps2 KPA 1.35
Ps3 KPA 7.9
Po KPA
Q cc/sec
T °K 298
Pc KPA 0 .02 .04
Nra — Med. Air Load #2 Lams/Stage 1 2 3 / 8 4 2
ΔPo, kPa
ΔPc, kPa
0.02
0.01
0
0.01
0.02
0.04
0.03
0.02
0.01
0
0.01
0.02
0.03
0.04
1
2
3

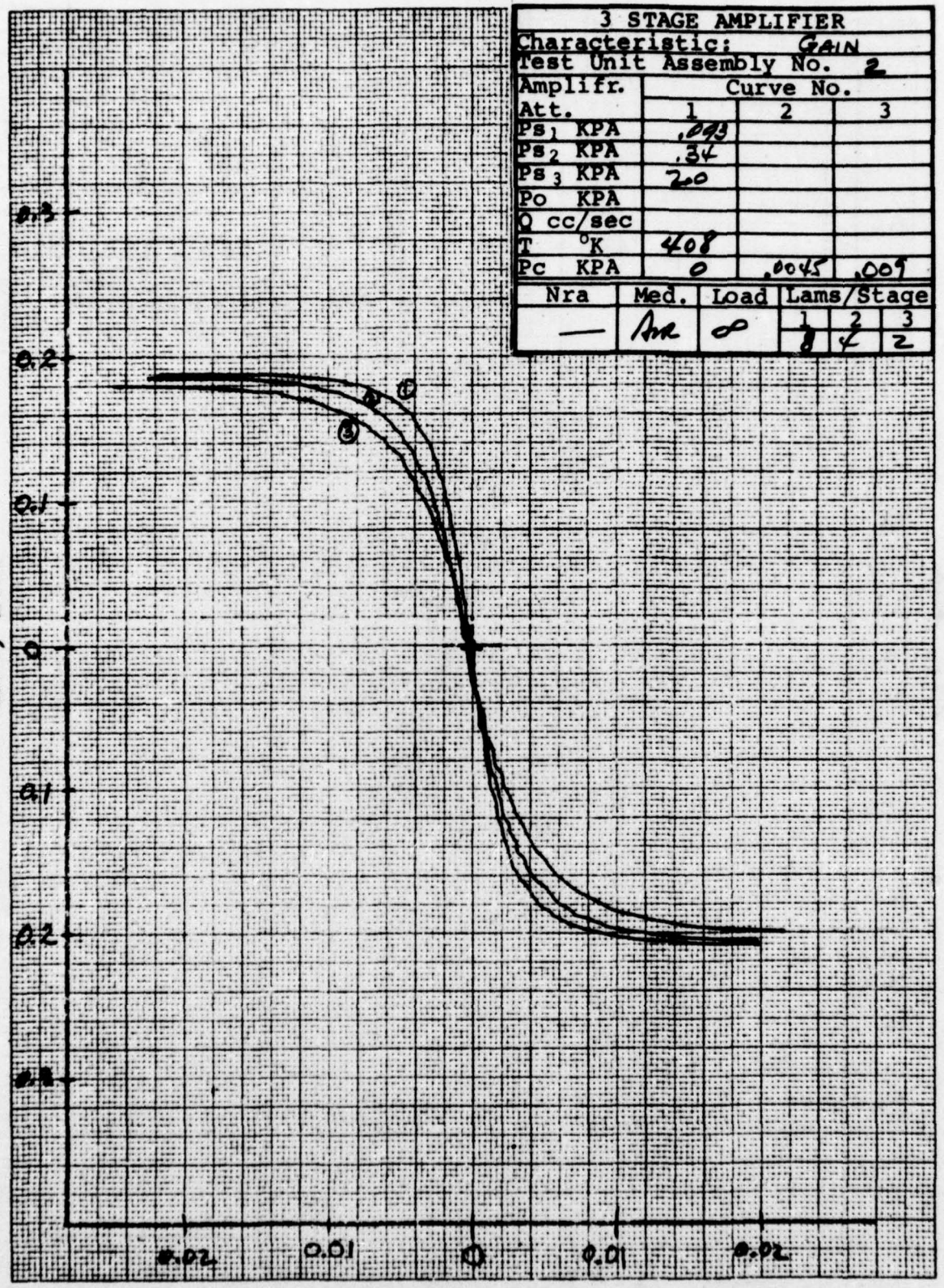

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 2
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .37 .37 .37
Ps2 KPA 1.35 1.35 1.35
Ps3 KPA 7.9 7.9 7.9
Po KPA
Q cc/sec
T °K 353 353 353
Pc KPA 0 .018 .037
Nra 85
Med. Air
Load #2
Lams/Stage 1 2 3 / 8 4 2
0.16
0.12
0.08
0.04
0
0.04
0.08
0.12
0.16
ΔPo, kPa
0.02
0.01
0
0.01
0.02
ΔPc, kPa
1
2
3

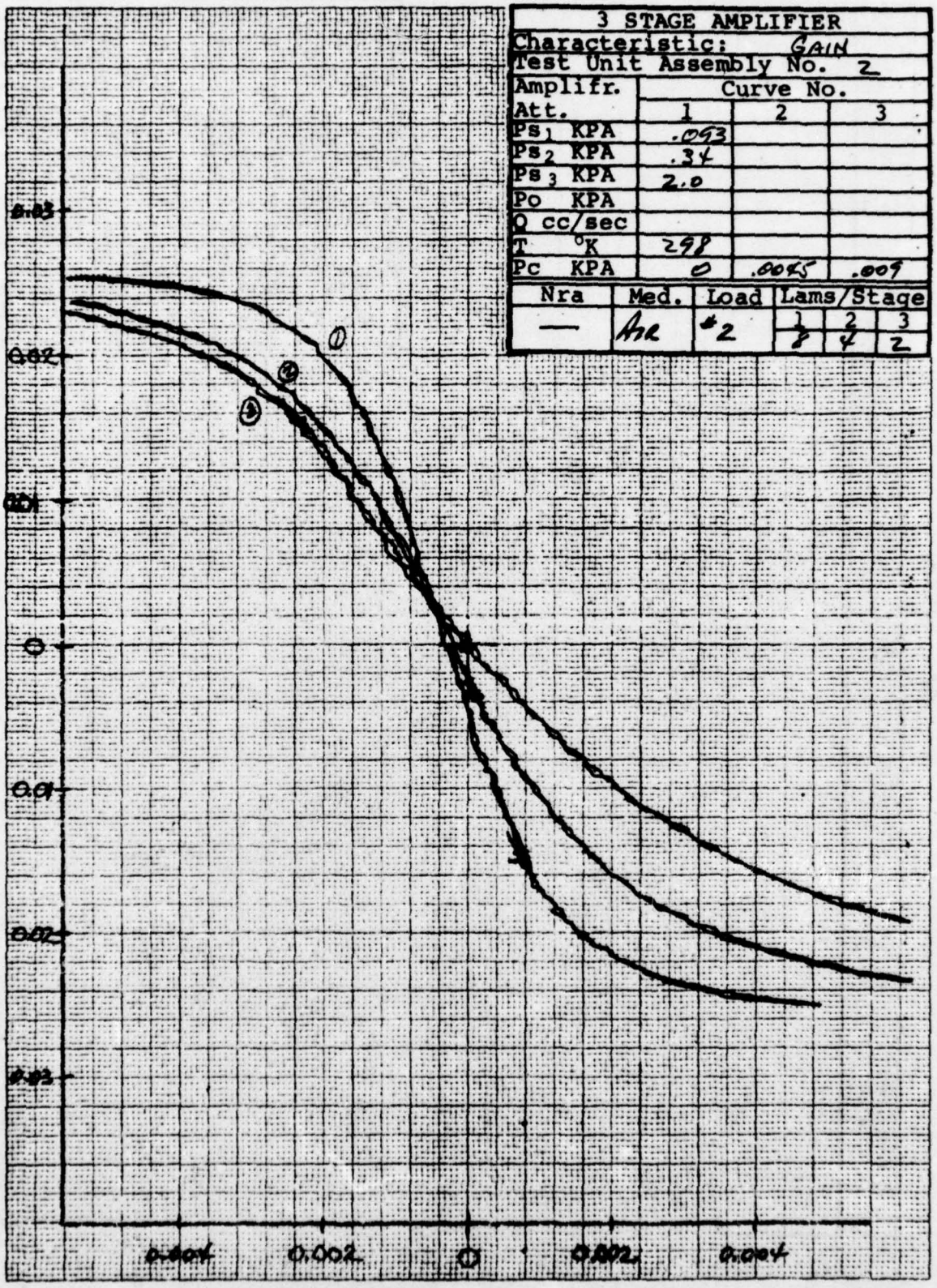

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 2
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .37
Ps2 KPA 1.35
Ps3 KPA 2.9
Po KPA
Q cc/sec
T °K 408
Pc KPA 0 .02 .04
Nra — Med. Air Load #2 Lams/Stage 1 2 3 8 4 2
0.16
0.12
0.08
0.04
0
0.04
0.08
0.12
0.16
0.04
0.02
0
0.02
0.04
ΔPo, kPa
ΔPc, kPa

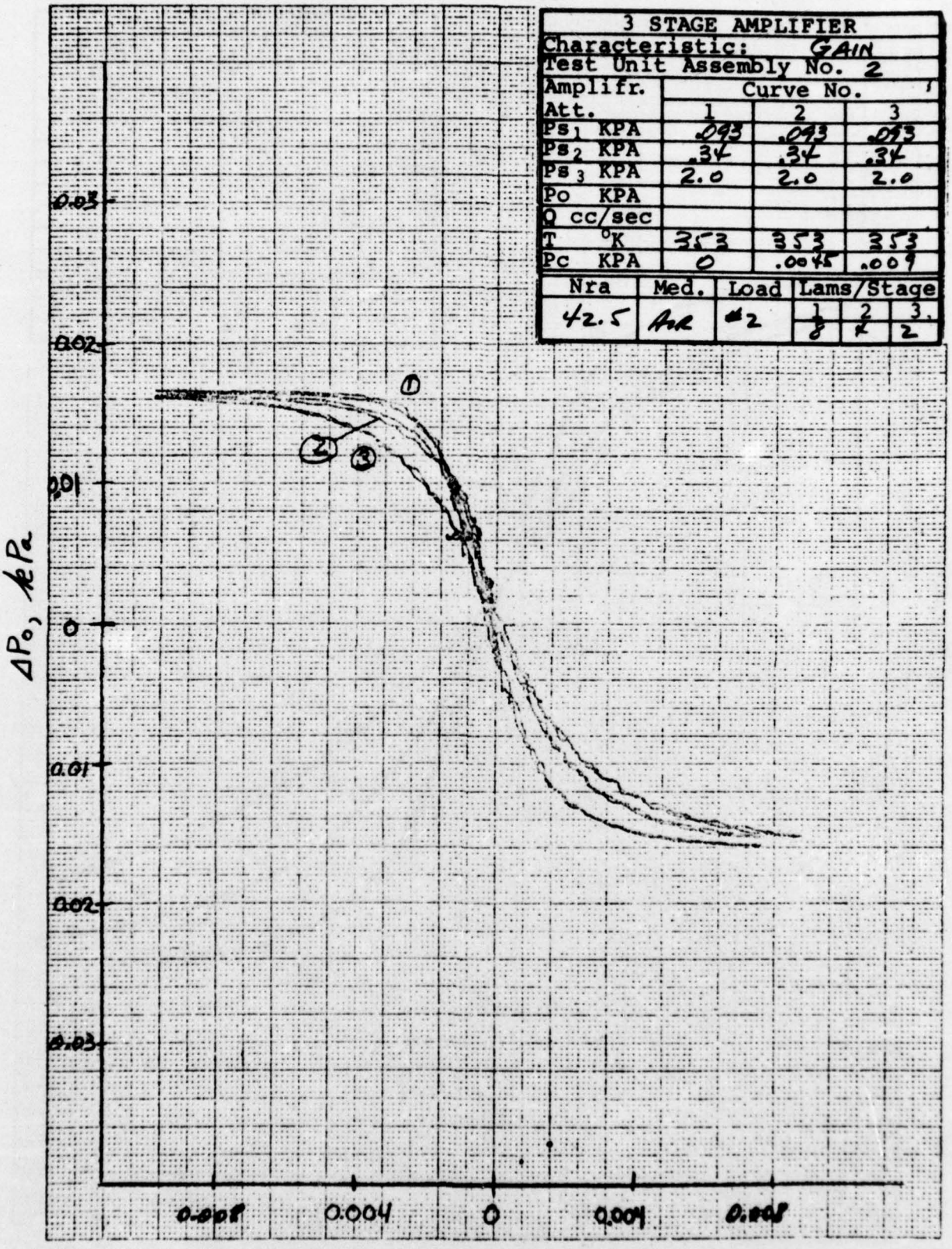

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Curve No.
Att. 1 2 3
Ps1 KPA .093
Ps2 KPA .34
Ps3 KPA 2.0
Po KPA
Q cc/sec
T °K 298
Pc KPA 0 .0045 .009
Nra Med. Load Lams/Stage
— Air ∞ 1/8 2/4 3/2
0.6
0.4
0.2
0
0.2
0.4
0.6
ΔPo, kPa
-0.004
-0.002
0
0.002
0.004
ΔPc, kPa
1
3

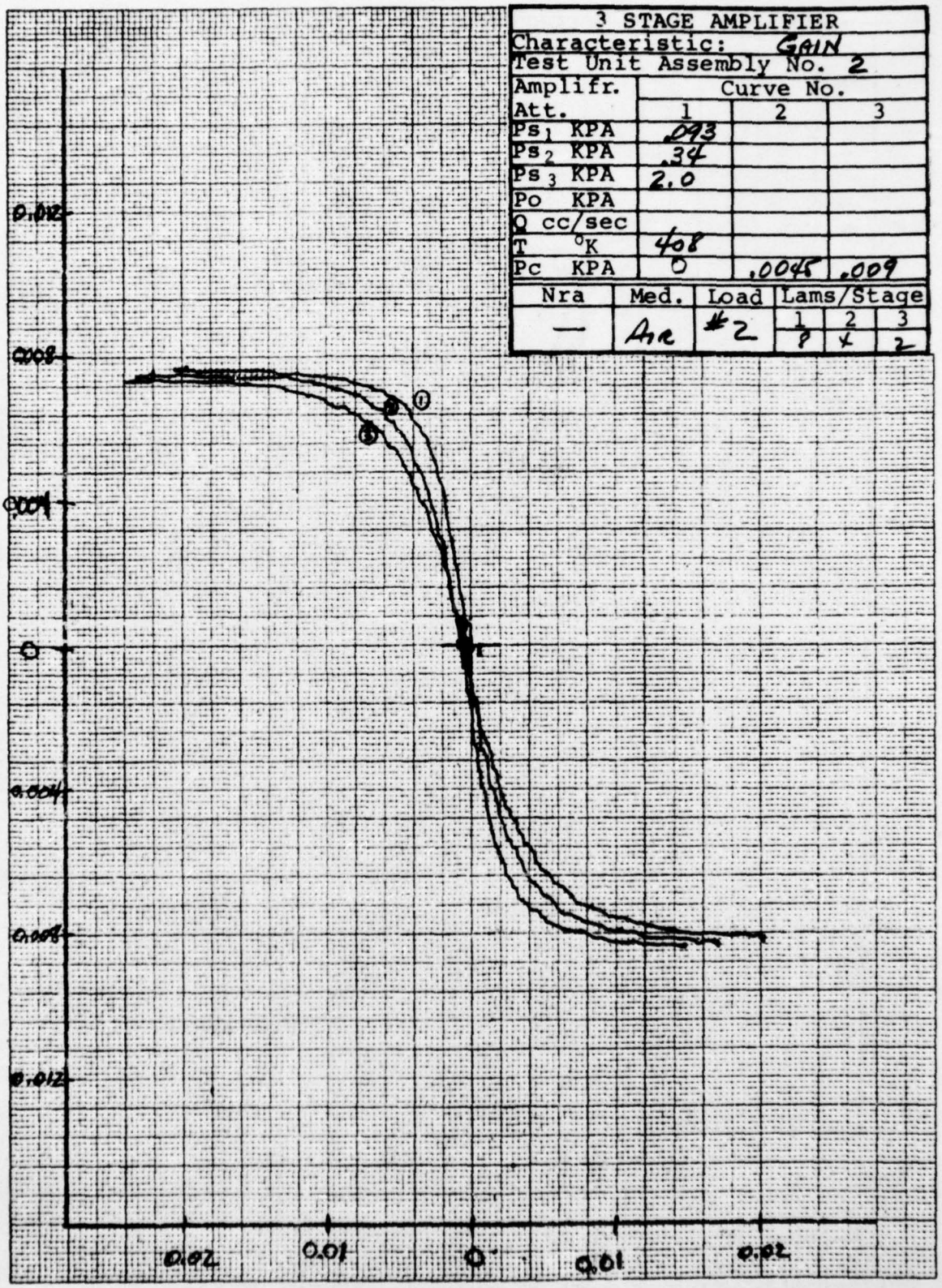

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 2
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .093
Ps2 KPA .34
Ps3 KPA 2.0
Po KPA
Q cc/sec
T °K 298
Pc KPA 0 .0045 .009
Nra — Med. Air Load ∞
Lams/Stage 1 2 3 = 8 4 2
0.6
0.4
0.2
0
0.2
0.4
0.6
ΔPa, kPa
0.004
0.002
0
0.002
0.004
ΔPc, kPa

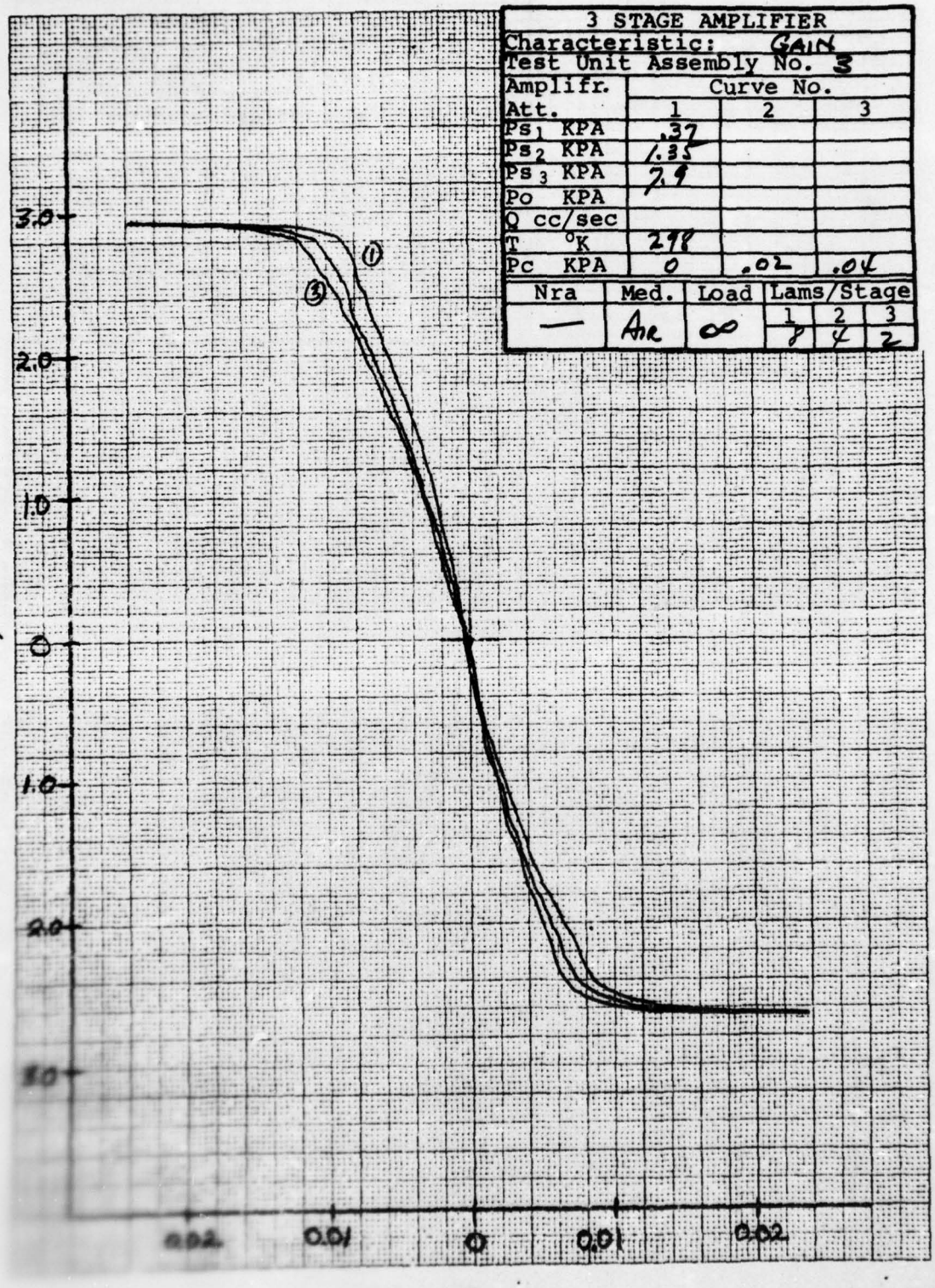

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 2
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .093 .093 .093
Ps2 KPA .34 .34 .34
Ps3 KPA 2.0 2.0 2.0
Po KPA
Q cc/sec
T °K 353 353 353
Pc KPA 0 .0045 .009
Nra 42.5
Med. Air
Load ∞
Lams/Stage 1 2 3
1/8 1/4 2
0.6
0.4
0.2
0
0.2
0.4
0.6
0.008
0.004
0
0.004
0.008
ΔPo, kPa
ΔPc, kPa

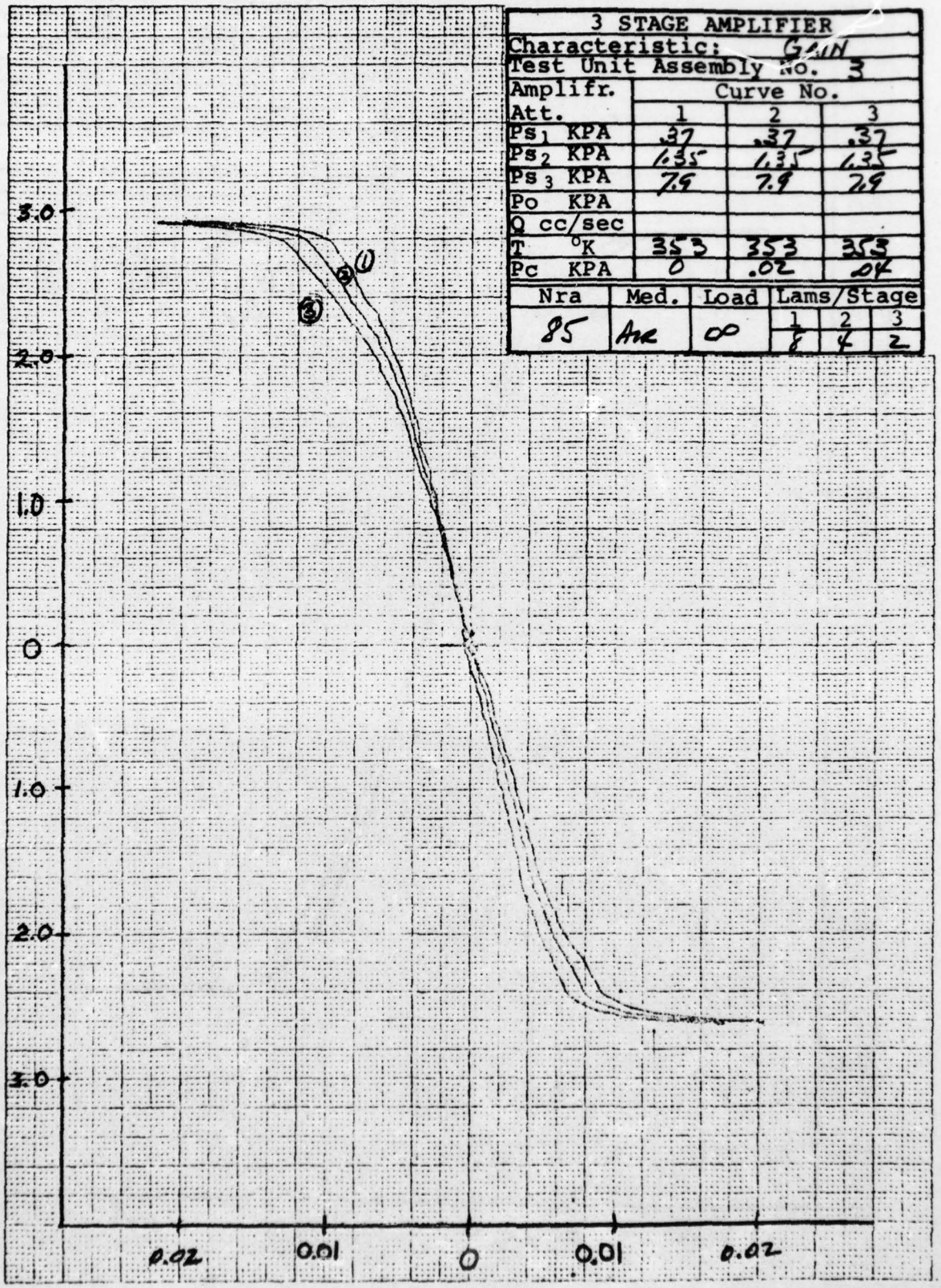

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 2
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .093
Ps2 KPA .34
Ps3 KPA 2.0
Po KPA
Q cc/sec
T °K 408
Pc KPA 0 .0045 .009
Nra — Med. Air Load ∞ Lams/Stage 1 8 2 4 3 2
0.3
0.2
0.1
0
0.1
0.2
0.3
0.02
0.01
0
0.01
0.02
ΔPo, kPa
ΔPc, kPa

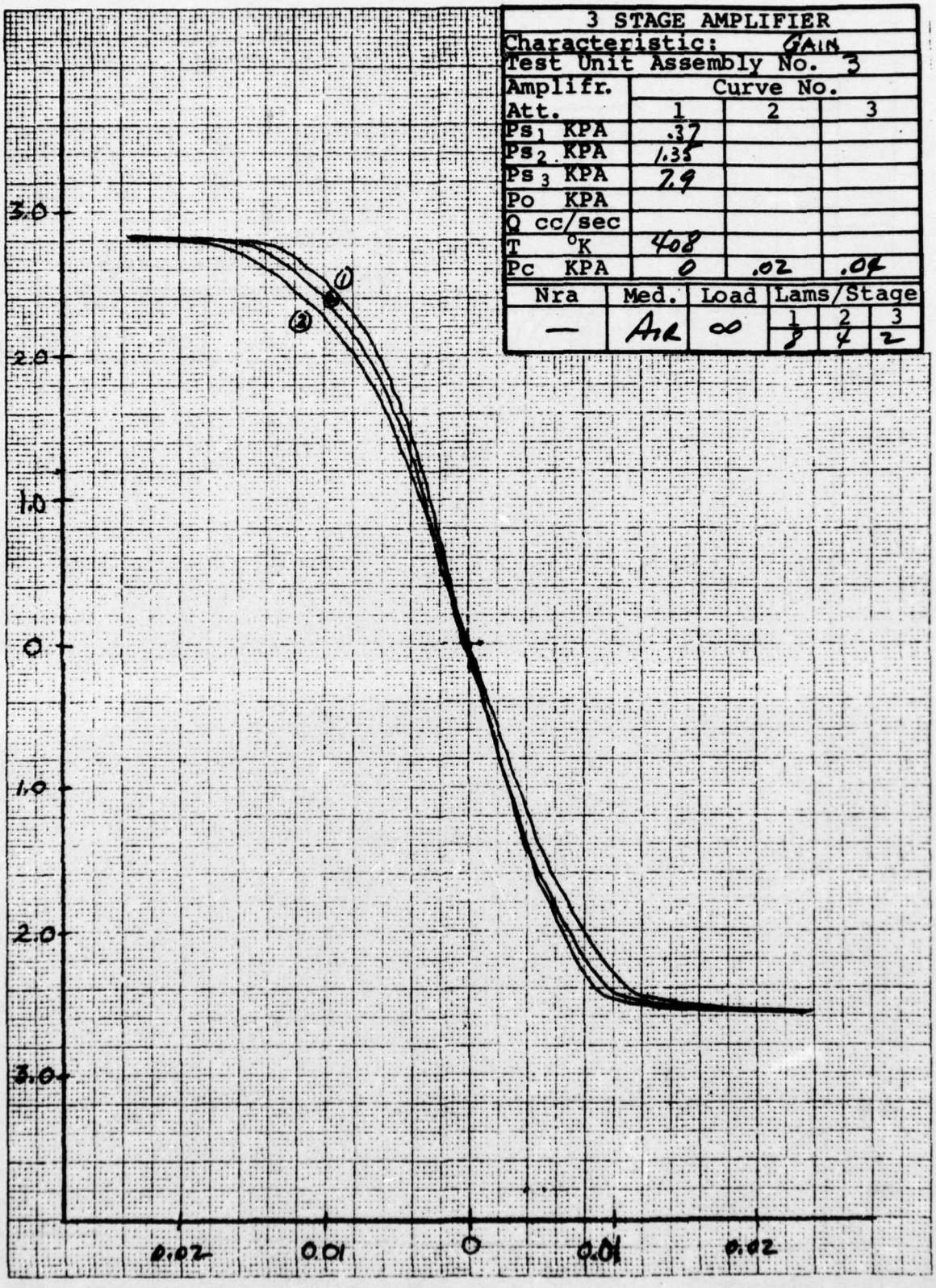

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 2
Amplifr. Att.
Curve No.
1
2
3
Ps1 KPA .093
Ps2 KPA .34
Ps3 KPA 2.0
Po KPA
Q cc/sec
T °K 298
Pc KPA 0 .0045 .009
Nra — Med. Air Load #2 Lams/Stage 1/8 2/4 3/2
0.03
0.02
0.01
0
0.01
0.02
0.03
0.004
0.002
0
0.002
0.004
ΔPo, kPa
ΔPc, kPa

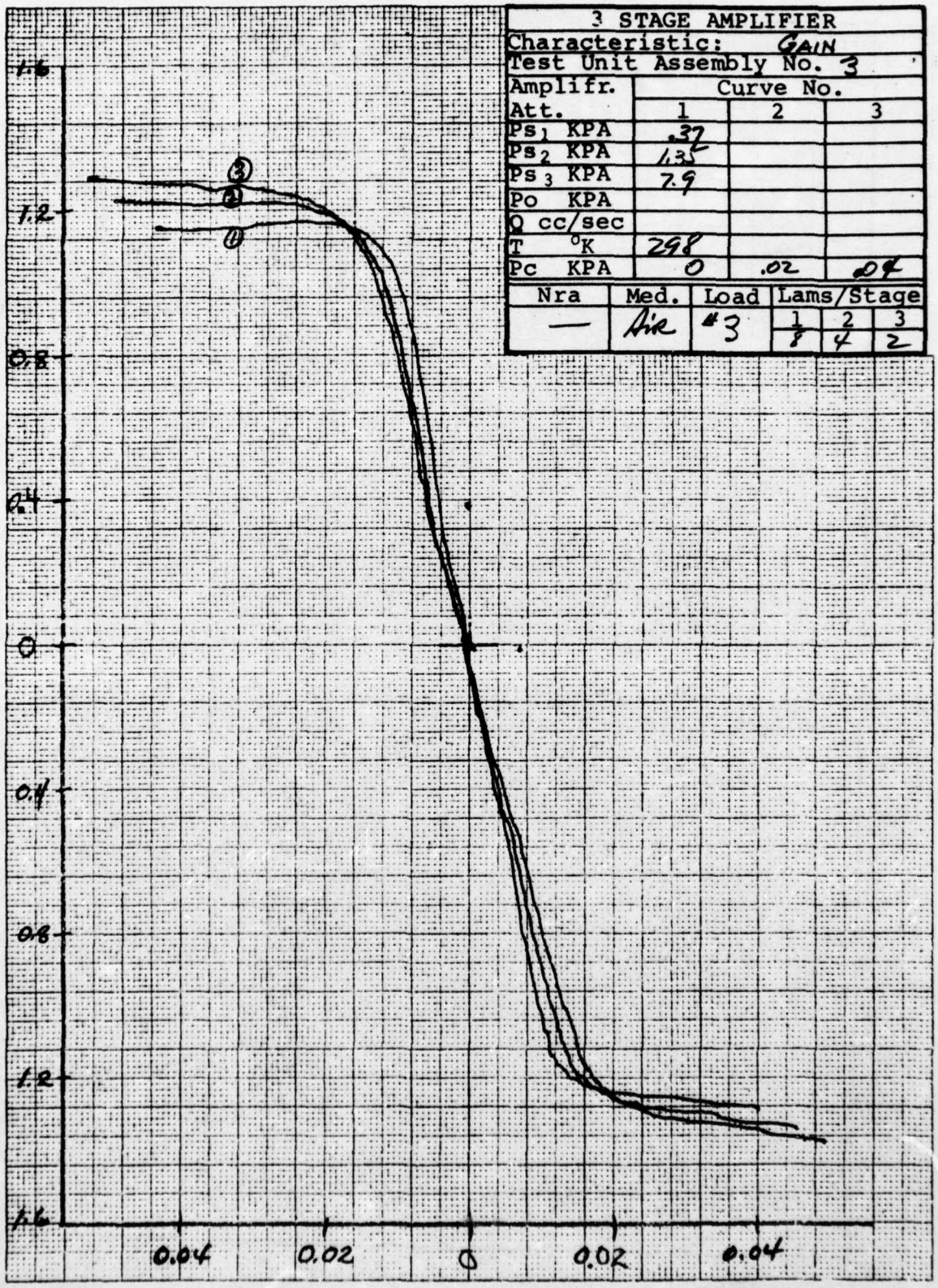

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 2
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .093 .093 .093
Ps2 KPA .34 .34 .34
Ps3 KPA 2.0 2.0 2.0
Po KPA
Q cc/sec
T °K 353 353 353
Pc KPA 0 .0045 .009
Nra 42.5
Med. Air
Load #2
Lams/Stage 1/8 2/4 3/2
0.03
0.02
0.01
0
0.01
0.02
0.03
ΔPo, kPa
0.008
0.004
0
0.004
0.008
ΔPc, kPa
1
2
3

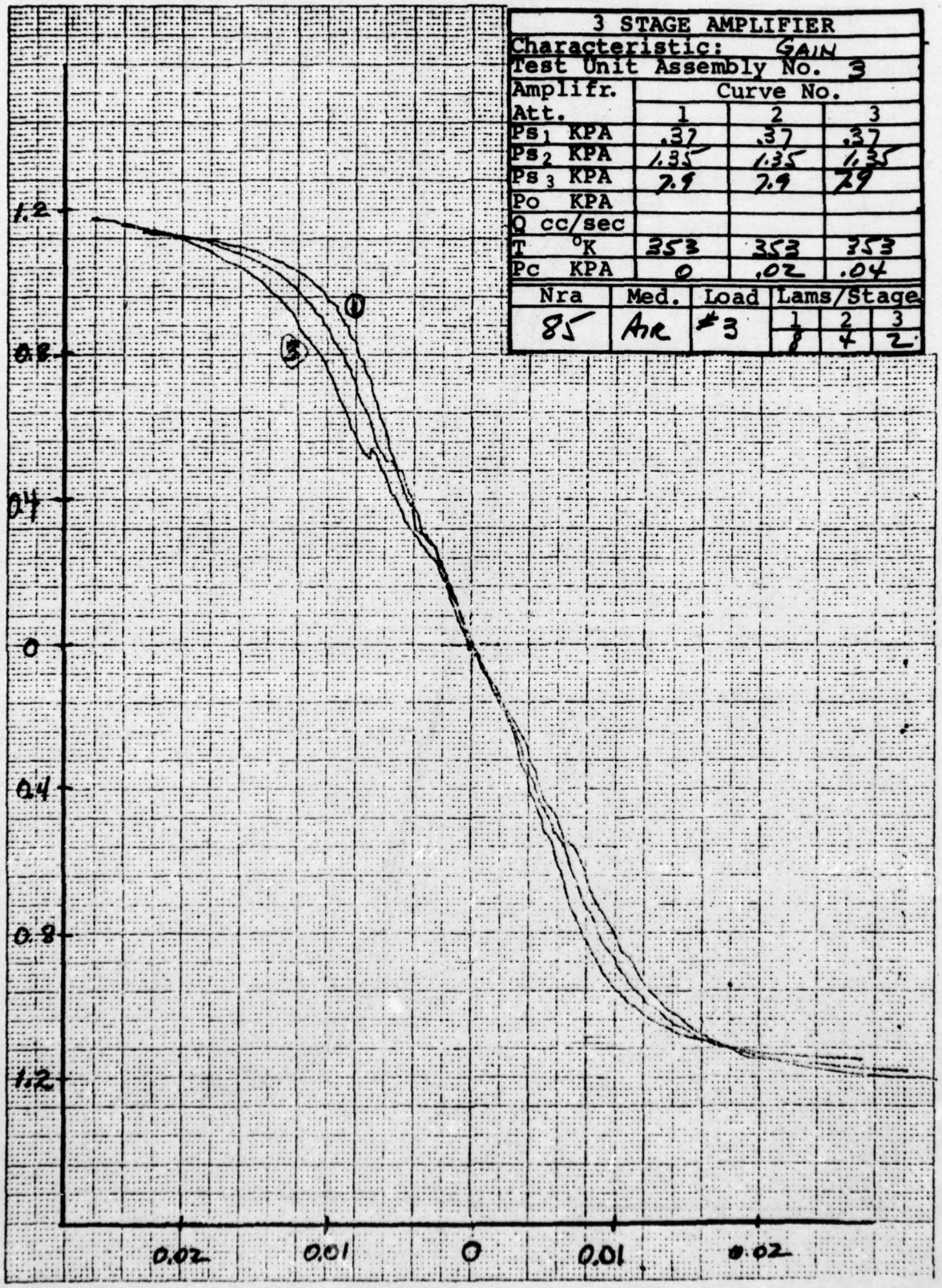

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 2
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .093
Ps2 KPA .34
Ps3 KPA 2.0
Po KPA
Q cc/sec
T °K 408
Pc KPA 0 .0045 .009
Nra — Med. Air Load #2 Lams/Stage 1 p 2 4 3 2
0.012
0.008
0.004
0
0.004
0.008
0.012
ΔPo, kPa
0.02
0.01
0
0.01
0.02
ΔPc, kPa

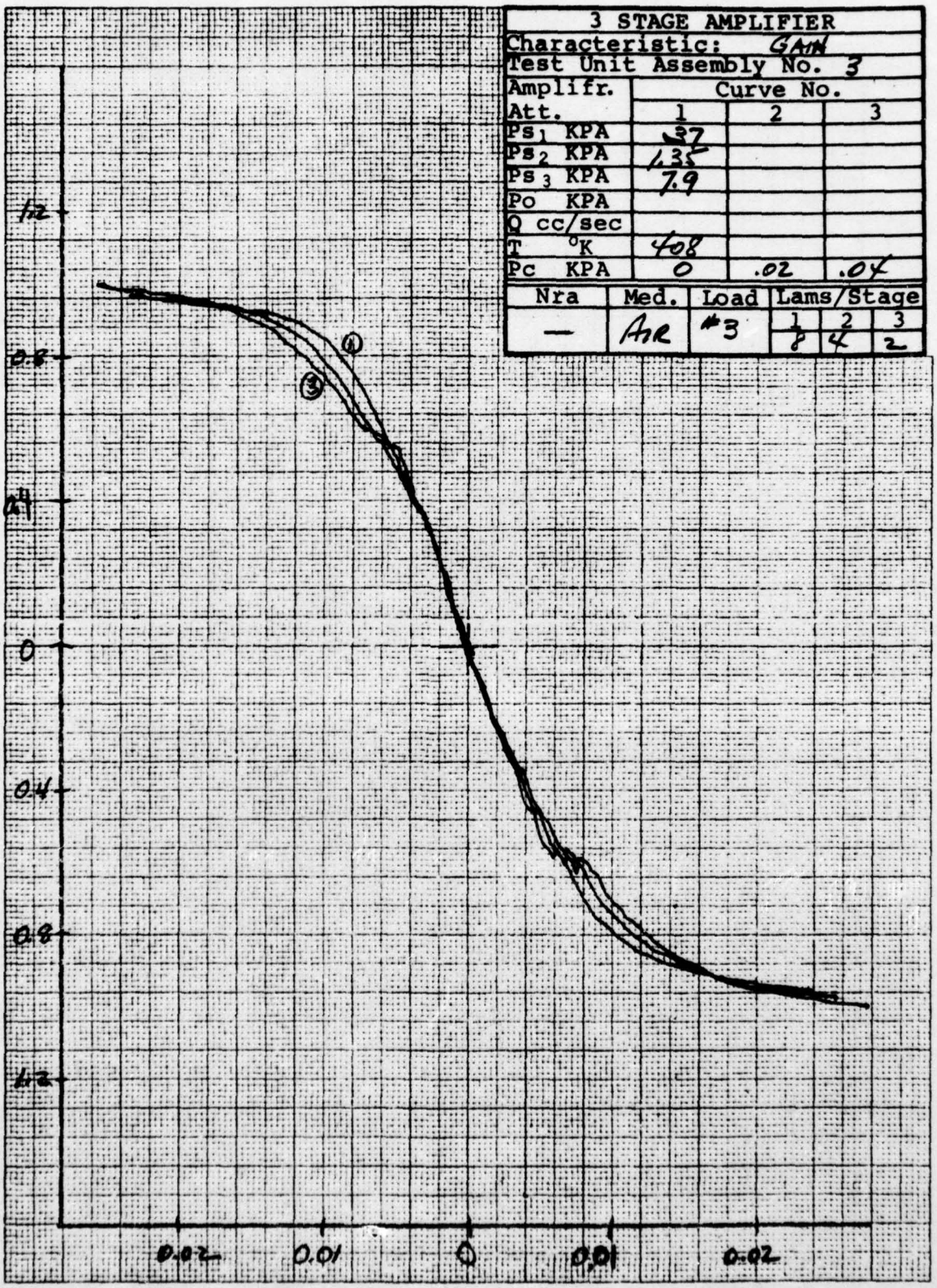

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Curve No.
Att. 1 2 3
Ps1 KPA .37
Ps2 KPA 1.35
Ps3 KPA 7.9
Po KPA
Q cc/sec
T °K 298
Pc KPA 0 .02 .04
Nra Med. Load Lams/Stage 1 2 3
— Air ∞ 7 4 2
3.0
2.0
1.0
0
1.0
2.0
3.0
0.02
0.01
0
0.01
0.02
ΔPo, kPa
ΔPc, kPa
①
②
③

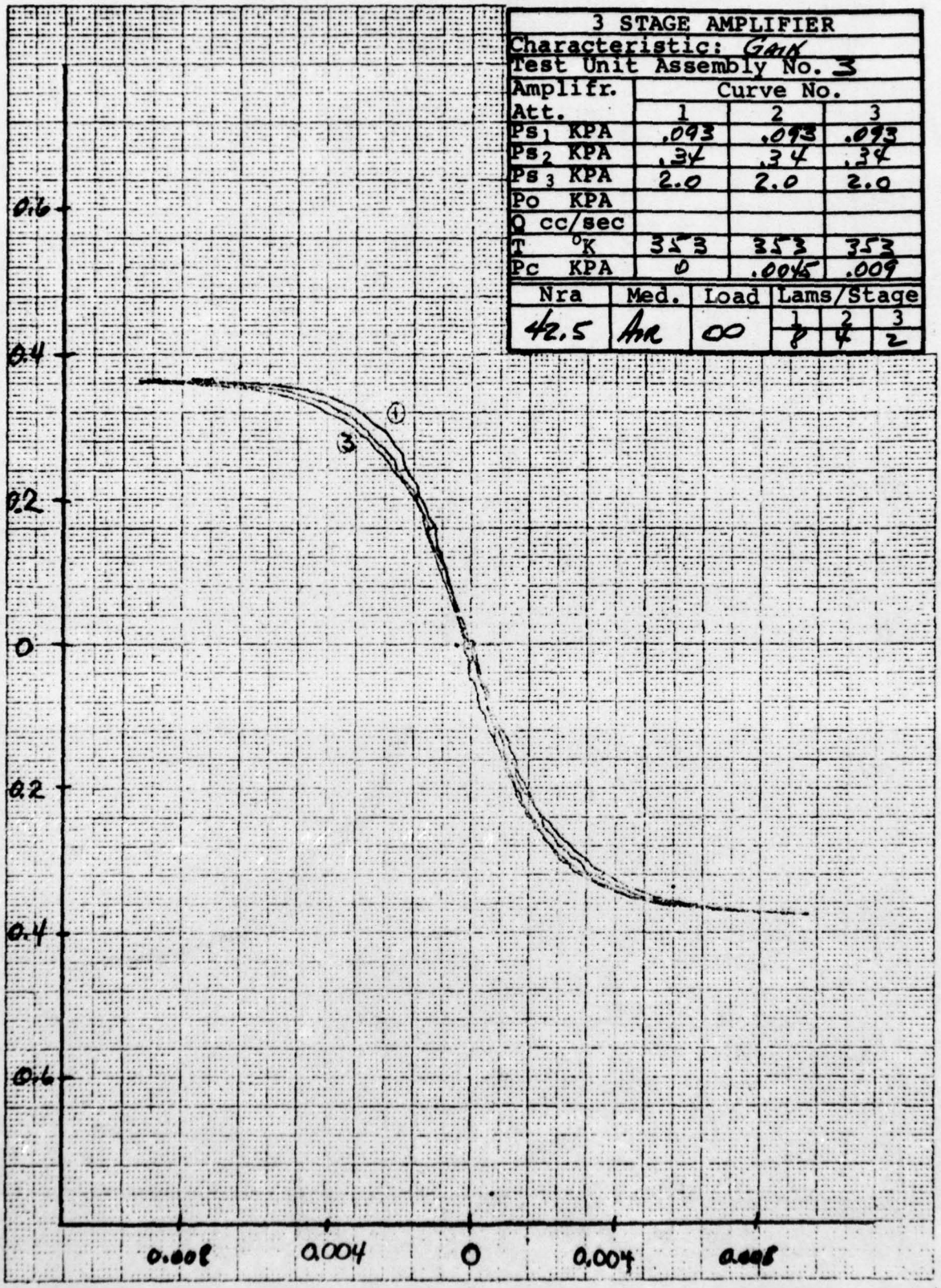

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .37 .37 .37
Ps2 KPA 1.35 1.35 1.35
Ps3 KPA 7.9 7.9 7.9
Po KPA
Q cc/sec
T °K 353 353 353
Pc KPA 0 .02 .04
Nra 85
Med. Air
Load ∞
Lams/Stage 1 2 3 — 8 4 2
3.0
2.0
1.0
0
1.0
2.0
3.0
ΔPo, kPa
0.02
0.01
0
0.01
0.02
ΔPc, kPa


3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .37
Ps2 KPA 1.35
Ps3 KPA 7.9
Po KPA
Q cc/sec
T °K 408
Pc KPA 0 .02 .04
Nra — Med. Air Load ∞ Lams/Stage 1 3 2 4 3 2
3.0
2.0
1.0
0
1.0
2.0
3.0
ΔPo, kPa
0.02
0.01
0
0.01
0.02
ΔPc, kPa


3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .37
Ps2 KPA 1.35
Ps3 KPA 7.9
Po KPA
Q cc/sec
T °K 298
Pc KPA 0 .02 .04
Nra — Med. Air Load #3 Lams/Stage 1/8 2/4 3/2
1.6
1.2
0.8
0.4
0
0.4
0.8
1.2
1.6
0.04
0.02
0
0.02
0.04
ΔPo, kPa
ΔPc, kPa

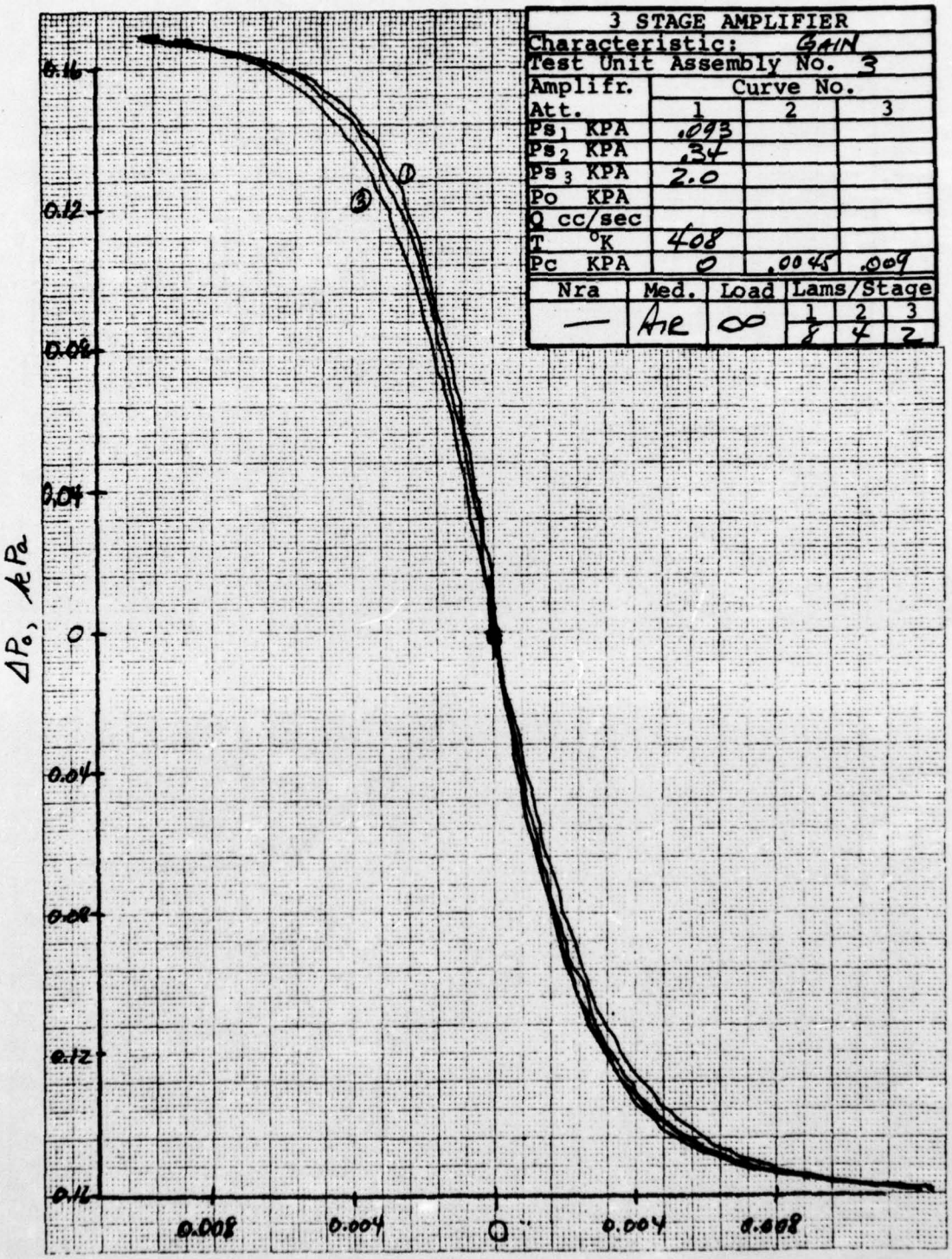

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Att. | Curve No. 1 | 2 | 3
Ps1 KPA | .37 | .37 | .37
Ps2 KPA | 1.35 | 1.35 | 1.35
Ps3 KPA | 7.9 | 7.9 | 7.9
Po KPA
Q cc/sec
T °K | 353 | 353 | 353
Pc KPA | 0 | .02 | .04
Nra | Med. | Load | Lams/Stage 1/8 | 2/4 | 3/2
85 | Air | #3
1.2
0.8
0.4
0
0.4
0.8
1.2
ΔPo, kPa
0.02
0.01
0
0.01
0.02
ΔPc, kPa

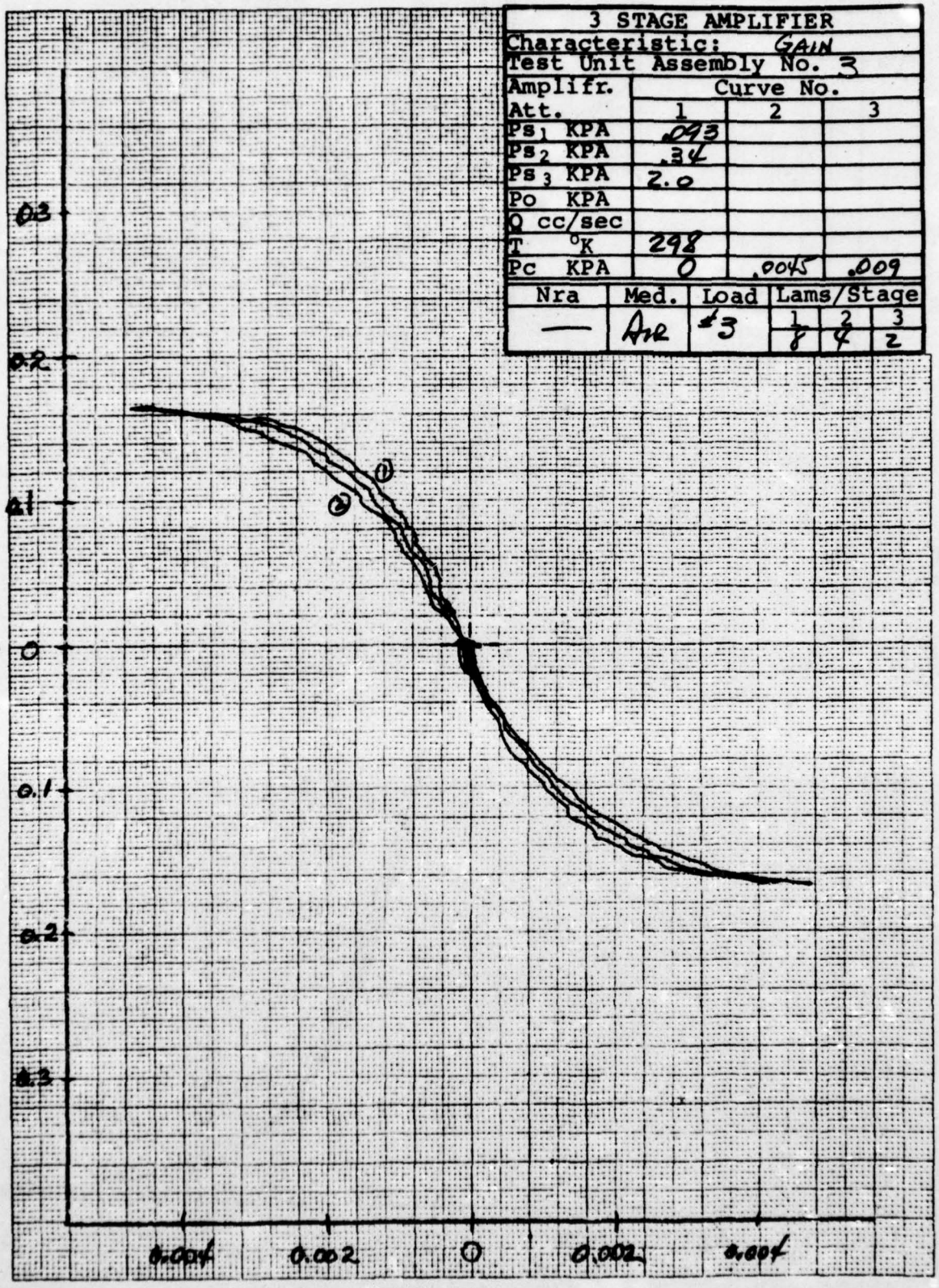

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA 37
Ps2 KPA 1.35
Ps3 KPA 7.9
Po KPA
Q cc/sec
T °K 408
Pc KPA 0 .02 .04
Nra — Med. Air Load #3 Lams/Stage 1 8 2 4 3 2
ΔPo, kPa
0.8
0
0.4
0.8
0.02
0.01
0
0.01
0.02
ΔPc, kPa

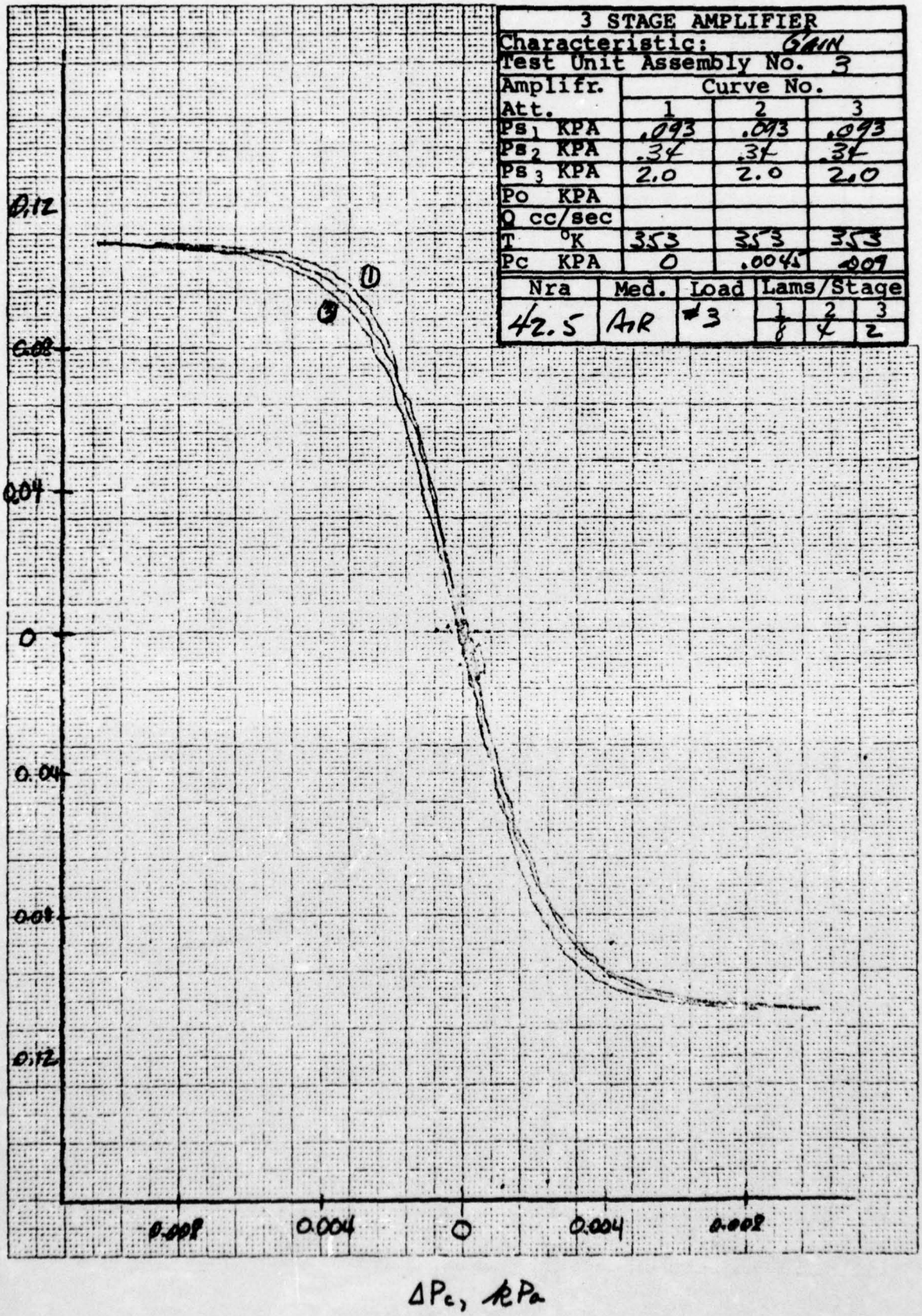

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Att. | Curve No. 1 | 2 | 3
Ps1 KPA | .093 | .093 | .093
Ps2 KPA | .34 | .34 | .34
Ps3 KPA | 2.0 | 2.0 | 2.0
Po KPA | | |
Q cc/sec | | |
T °K | 353 | 353 | 353
Pc KPA | 0 | .0045 | .009
Nra | Med. | Load | Lams/Stage 1 | 2 | 3
42.5 | Air | 00 | 1 | 4 | 2
0.6
0.4
0.2
0
0.2
0.4
0.6
ΔPo, kPa
0.008
0.004
0
0.004
0.008
ΔPc, kPa
1
2
3

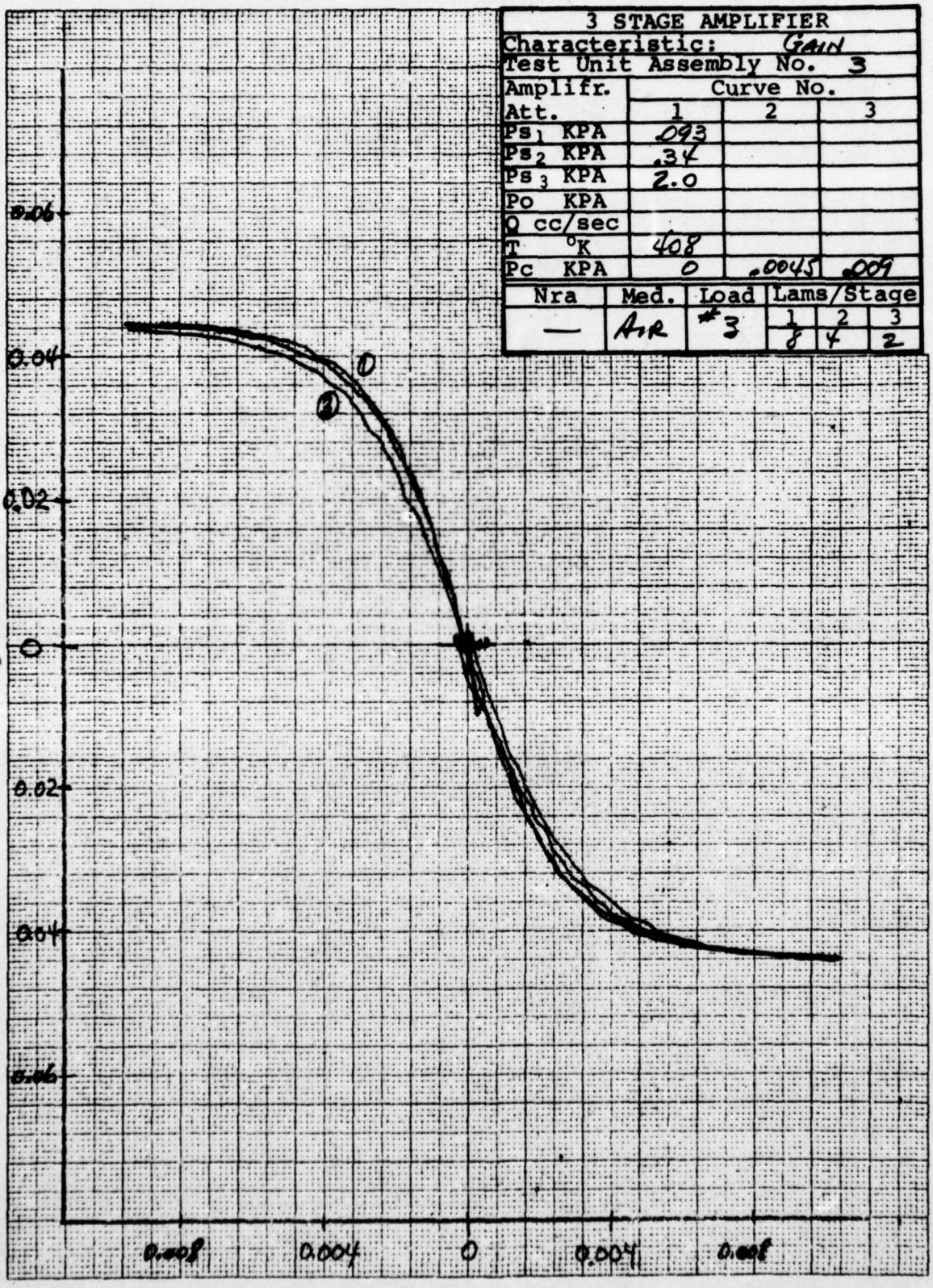
$\Delta P_c$, kPa

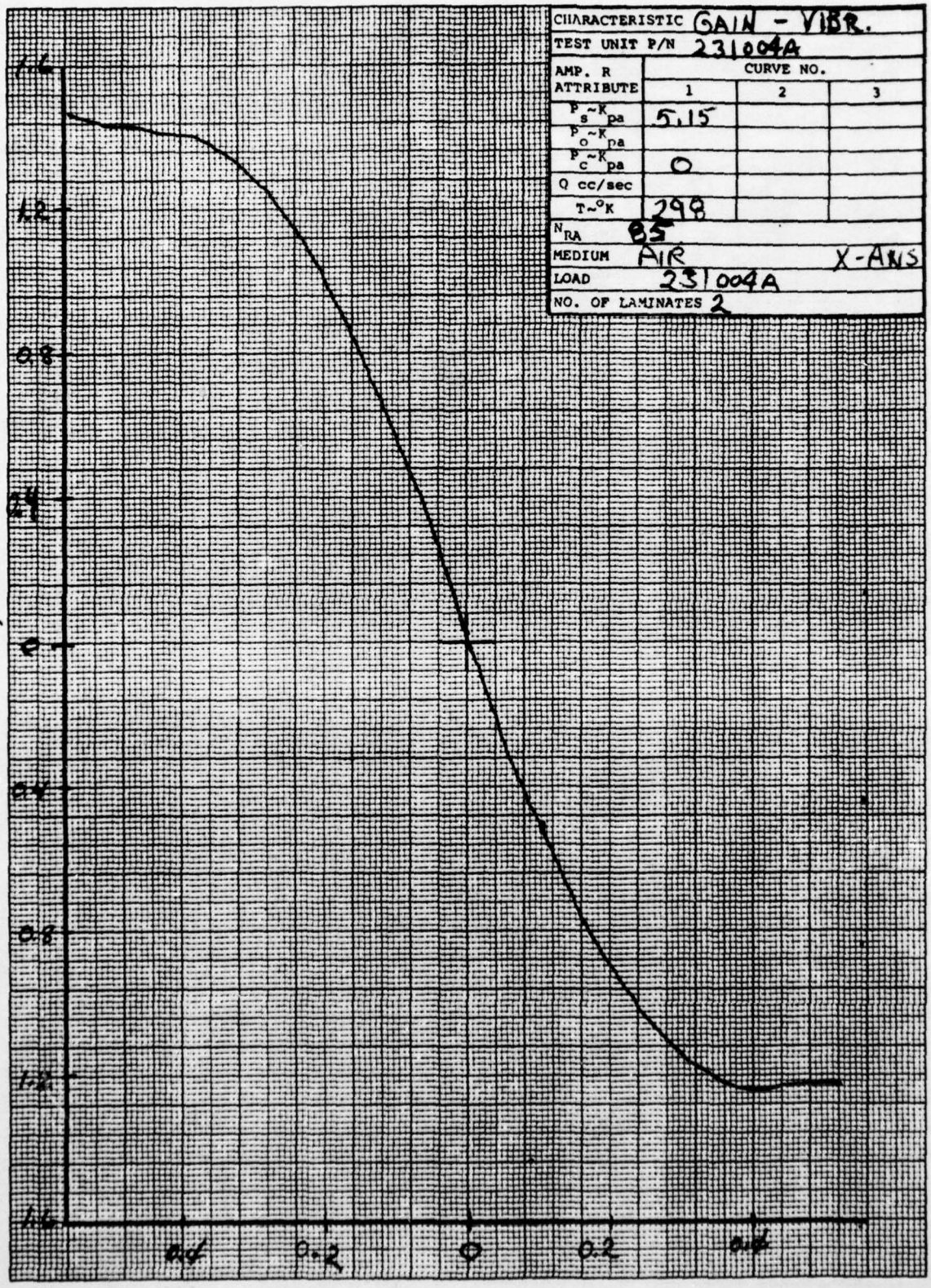


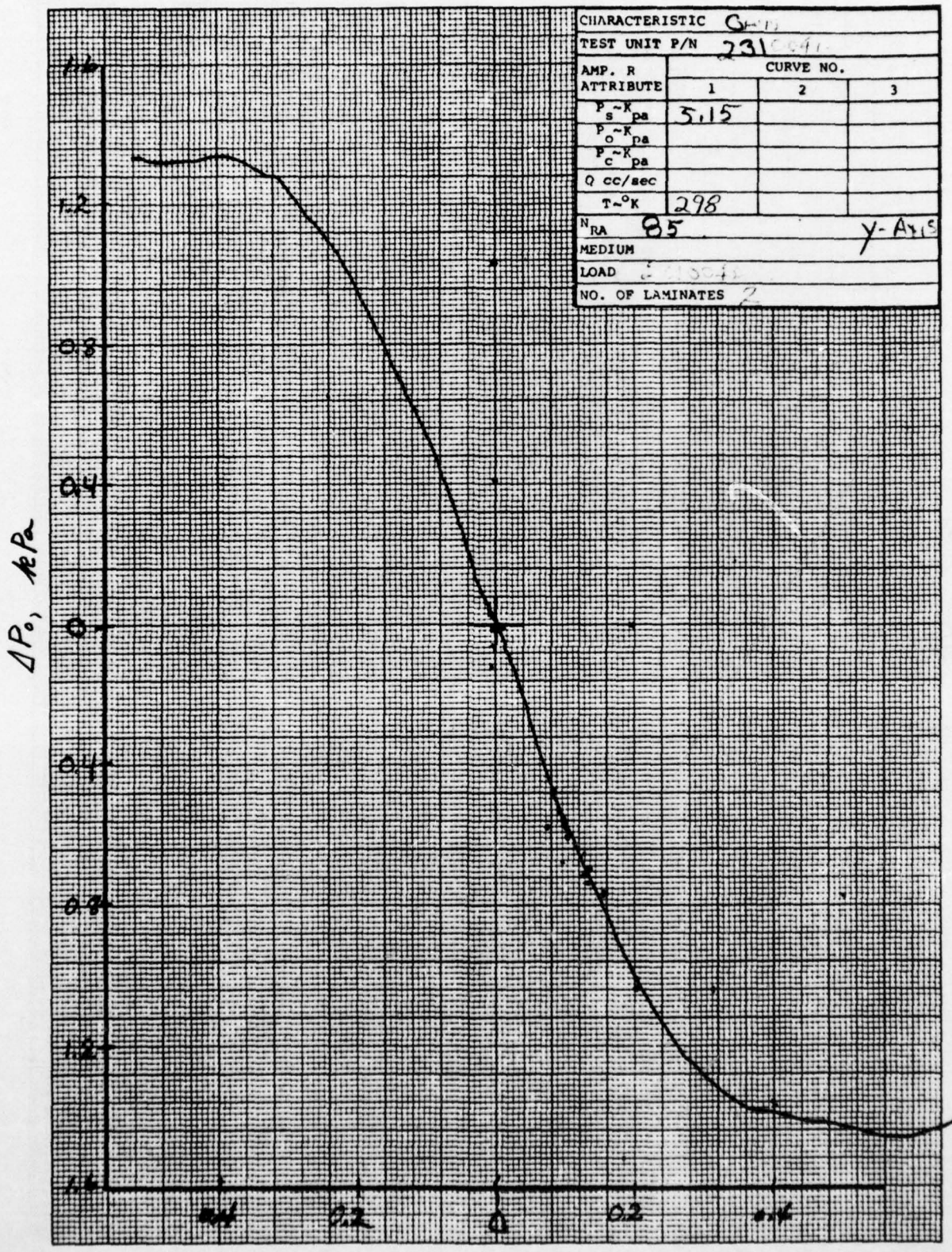

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Att. | Curve No. 1 | 2 | 3
Ps1 KPA | .093
Ps2 KPA | .34
Ps3 KPA | 2.0
Po KPA
Q cc/sec
T °K | 408
Pc KPA | 0 | .0045 | .009
Nra | Med. | Load | Lams/Stage 1 | 2 | 3
— | Air | ∞ | 1/8 | 4 | 2
0.16
0.12
0.08
0.04
0
0.04
0.08
0.12
0.008
0.004
0
0.004
0.008
ΔPo, kPa
ΔPc, kPa

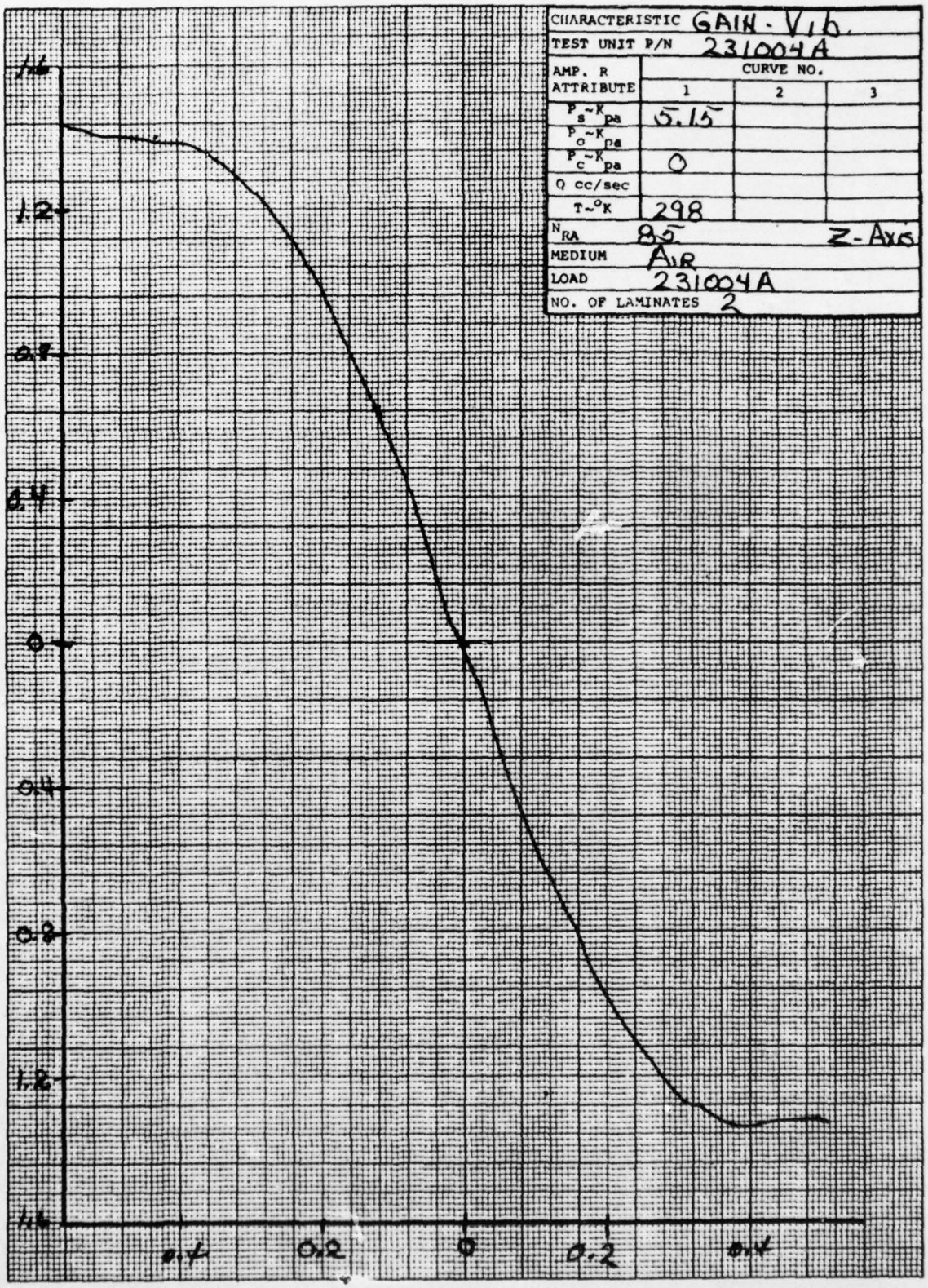

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Curve No.
Att. 1 2 3
Ps1 KPA .093
Ps2 KPA .34
Ps3 KPA 2.0
Po KPA
Q cc/sec
T °K 298
Pc KPA 0 .0045 .009
Nra Med. Load Lams/Stage
— Air #3 1/8 2/4 3/2
0.3
0.2
0.1
0
0.1
0.2
0.3
ΔPo, kPa
0.004
0.002
0
0.002
0.004
ΔPc, kPa


3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Att. | Curve No. 1 | 2 | 3
Ps1 KPA | .093 | .093 | .093
Ps2 KPA | .34 | .34 | .34
Ps3 KPA | 2.0 | 2.0 | 2.0
Po KPA
Q cc/sec
T °K | 353 | 353 | 353
Pc KPA | 0 | .0041 | .009
Nra | Med. | Load | Lams/Stage 1 | 2 | 3
42.5 | AIR | #3 | 1/8 | 4 | 2
0.12
0.08
0.04
0
0.04
0.08
0.12
ΔPo, kPa
0.008
0.004
0
0.004
0.008
ΔPc, kPa


3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .093
Ps2 KPA .34
Ps3 KPA 2.0
Po KPA
Q cc/sec
T °K 408
Pc KPA 0 .0045 .009
Nra — Med. AIR Load #3 Lams/Stage 1 2 3 / 8 4 2
0.06
0.04
0.02
0
0.02
0.04
0.06
0.008
0.004
0
0.004
0.008
ΔPo, kPa
ΔPc, kPa

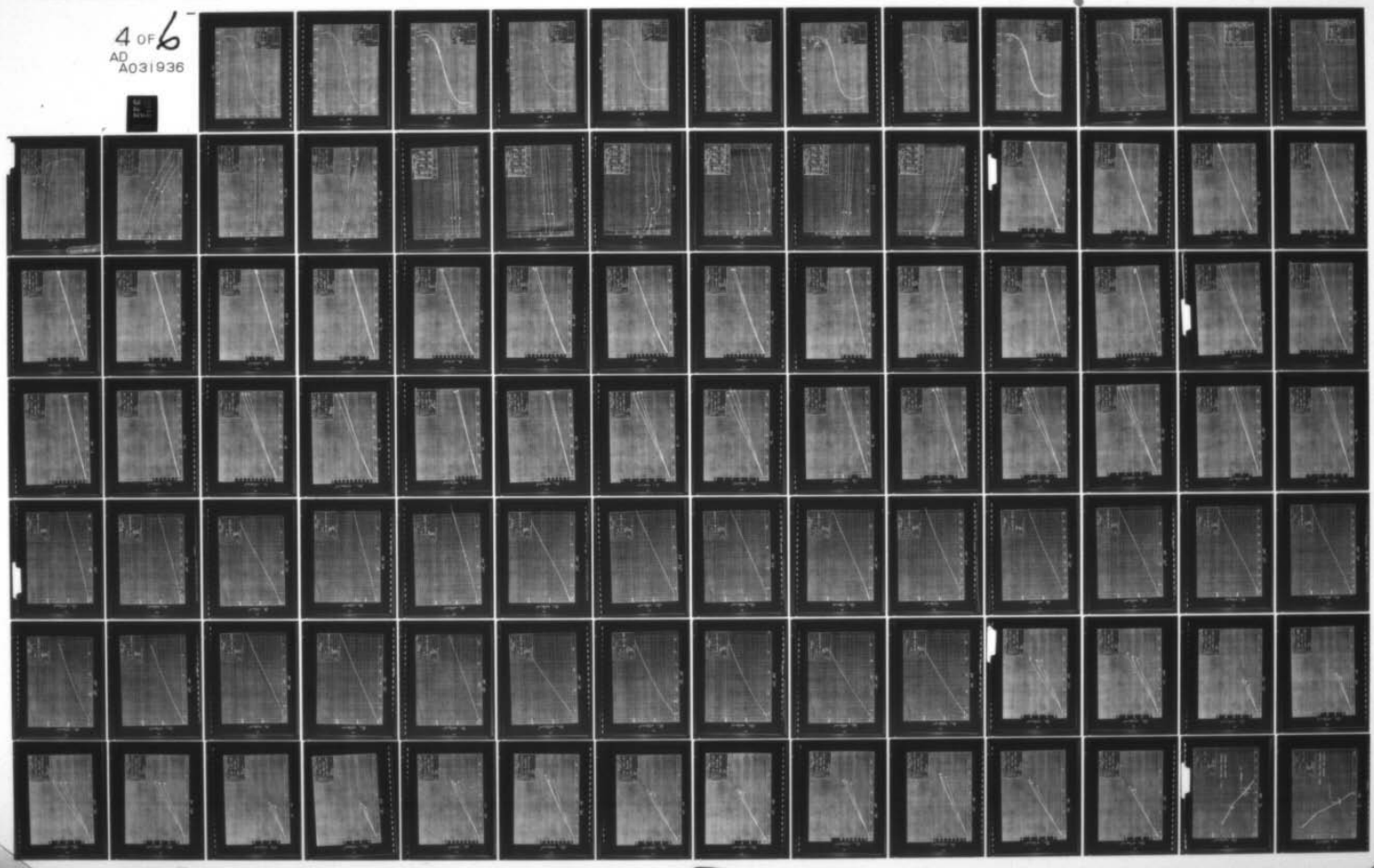

CHARACTERISTIC GAIN - VIBR.
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa 5.15
$P_o$~Kpa
$P_c$~Kpa 0
Q cc/sec
T~°K 298
$N_{RA}$ 85
MEDIUM AIR X-ANS
LOAD 231004A
NO. OF LAMINATES 2
ΔPo, kPa
ΔPc, kPa
0.2
0
0.2


CHARACTERISTIC
TEST UNIT P/N 231
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa 5.15
$P_o$~Kpa
$P_c$~Kpa
Q cc/sec
T~°K 298
$N_{RA}$ 85
y-Axis
MEDIUM
LOAD
NO. OF LAMINATES 2
1.2
0.8
0.4
0
0.4
0.8
1.2
0.2
0
0.2
$\Delta P_o$, kPa
$\Delta P_c$, kPa


CHARACTERISTIC GAIN - V16.
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa 5.15
$P_o$~Kpa
$P_c$~Kpa 0
Q cc/sec
T~°K 298
$N_{RA}$ 85
Z-Axis
MEDIUM AIR
LOAD 231004A
NO. OF LAMINATES 2
1.6
1.2
0.8
0.4
0
0.4
0.8
1.2
1.6
0.4
0.2
0
0.2
0.4
ΔPo, kPa
ΔPc, kPa

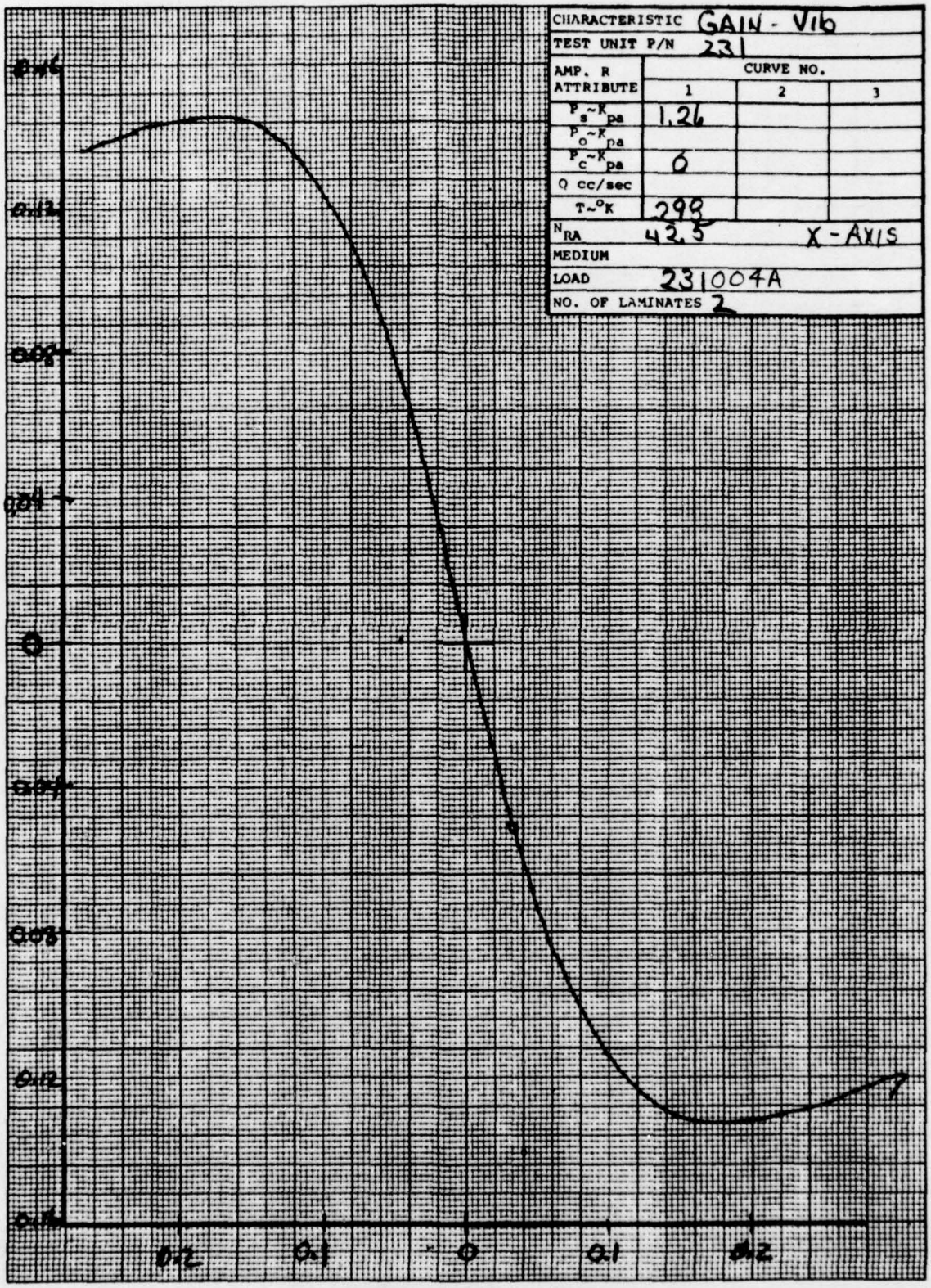
AD-A031 936 AIRESEARCH MFG CO OF ARIZONA PHOENIX F/G 20/4
ENVIRONMENTAL TEST PROGRAM FOR EVALUATION OF FLUIDIC ELEMENTS F--ETC(U)
DEC 75 M F CYCON, T G SUTTON, H R GAMBLE DAAG39-74-C-0187
UNCLASSIFIED 75-411145 HDL-CR-75-187-1 NL

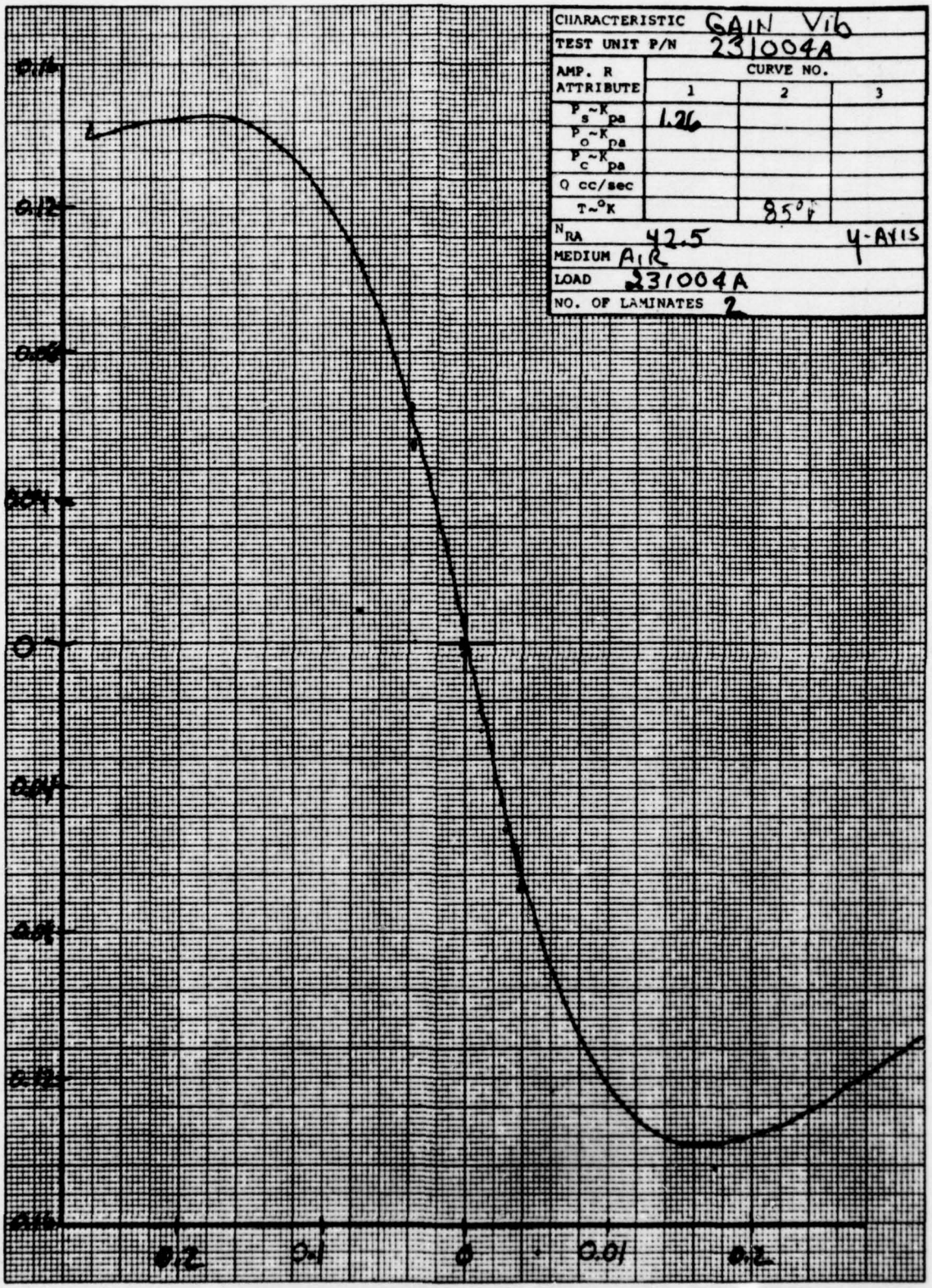
4 OF 6
AD A031936

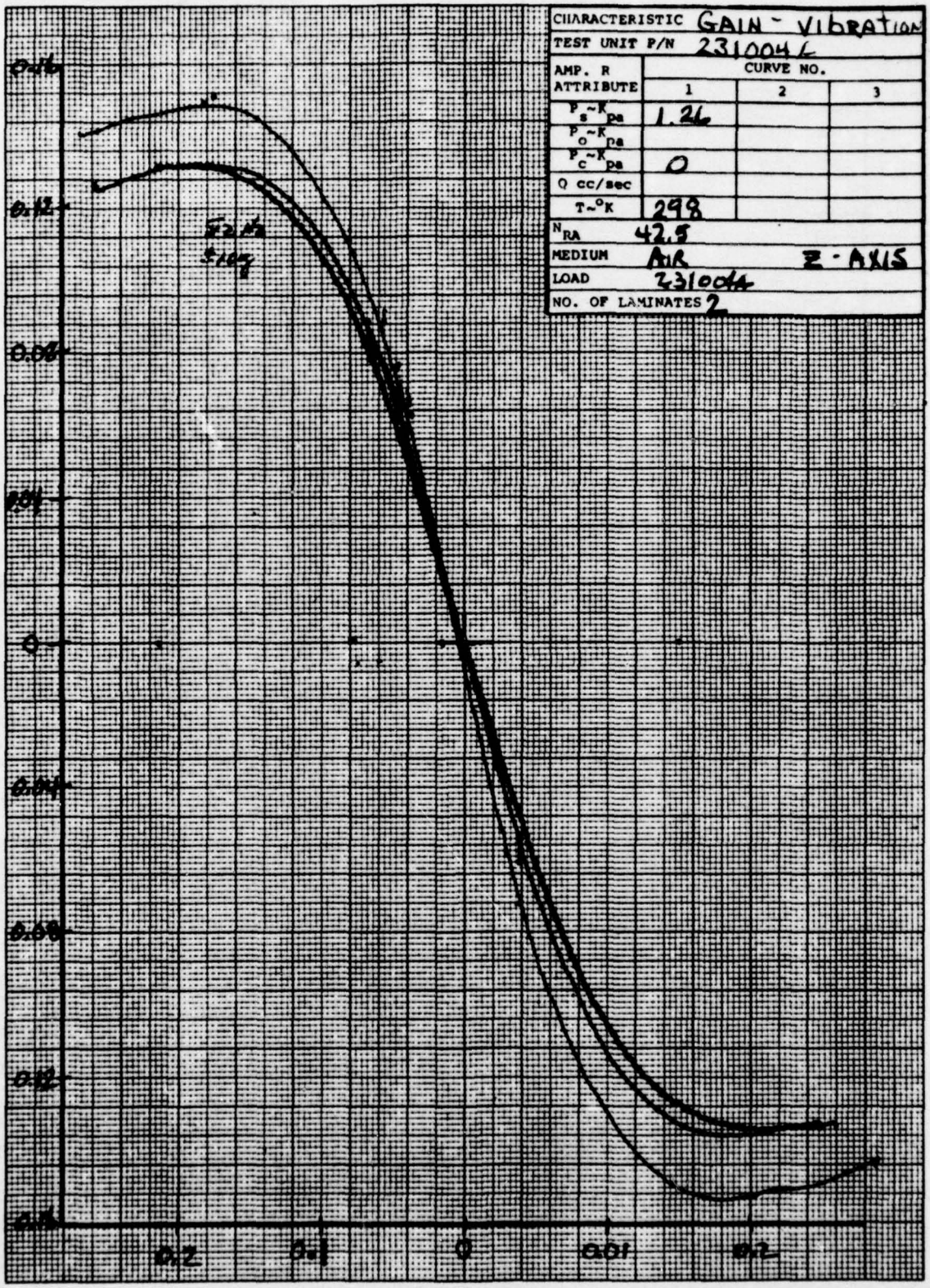


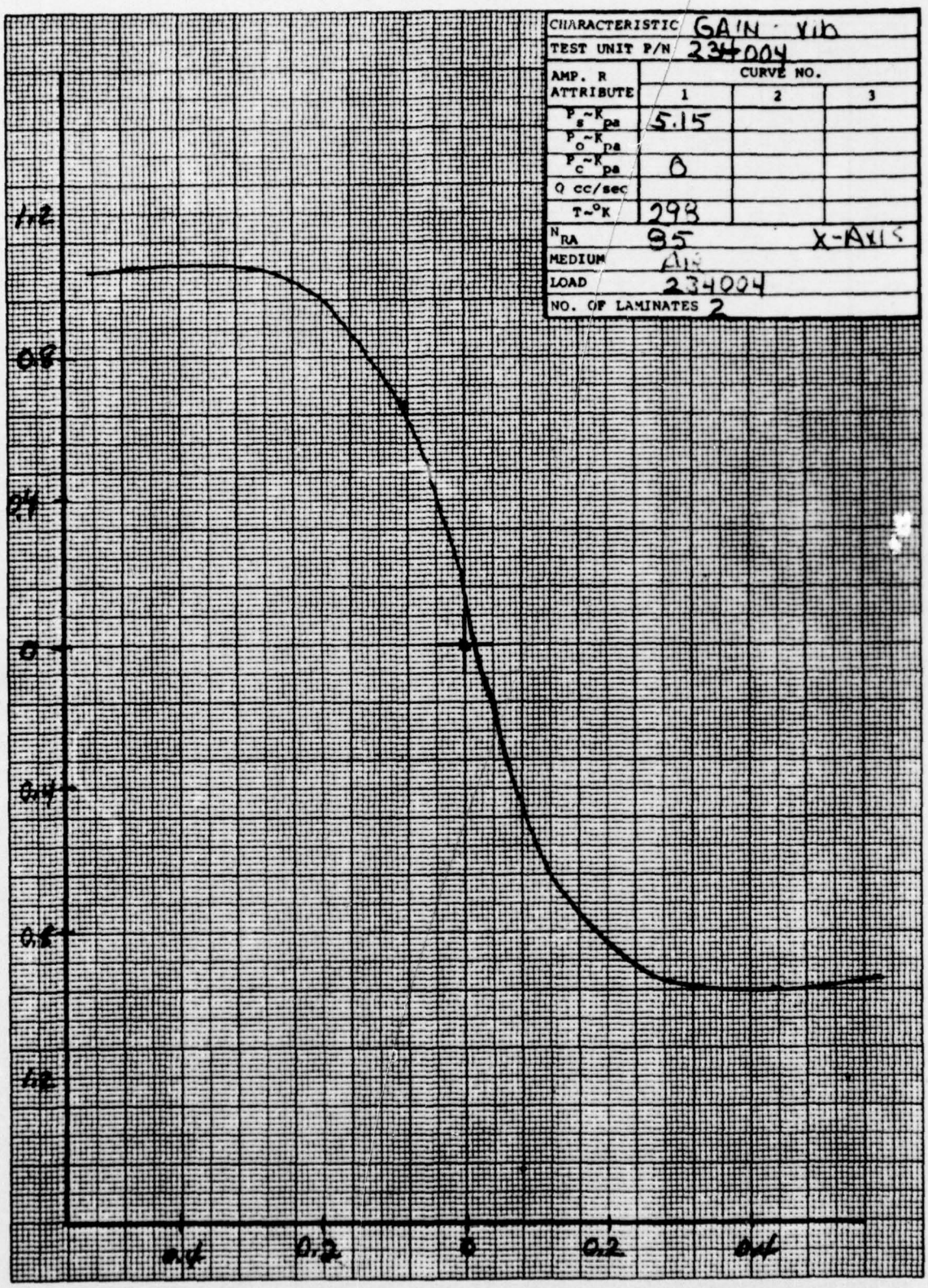
4 OF 6
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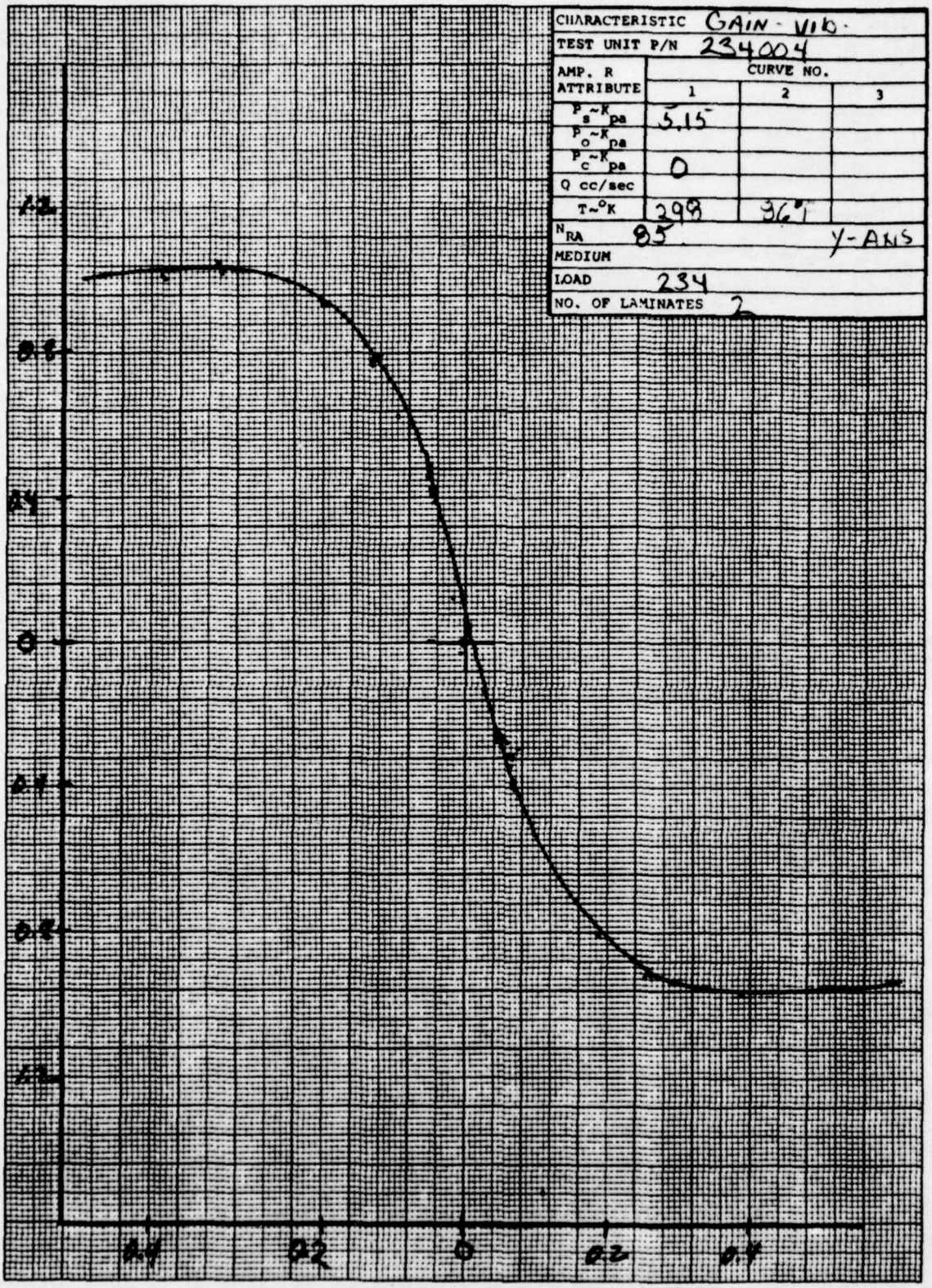


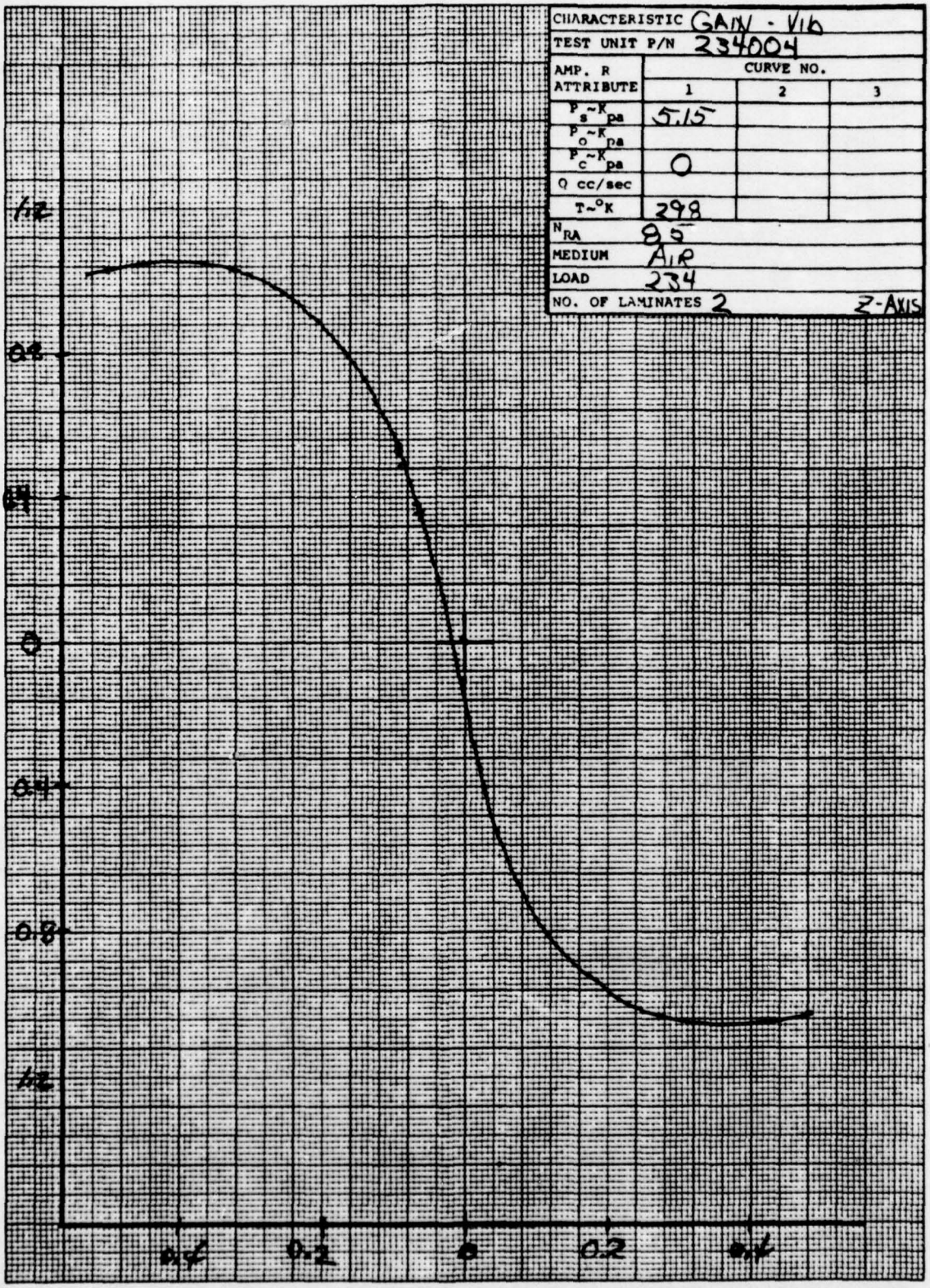

CHARACTERISTIC GAIN - V16
TEST UNIT P/N 231
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa 1.26
$P_o$~Kpa
$P_c$~Kpa 0
Q cc/sec
T~°K 298
$N_{RA}$ 43.3
X-AXIS
MEDIUM
LOAD 231004A
NO. OF LAMINATES 2
ΔPo, kPa
ΔPc, kPa
0.2
0.1
0
0.1
0.2

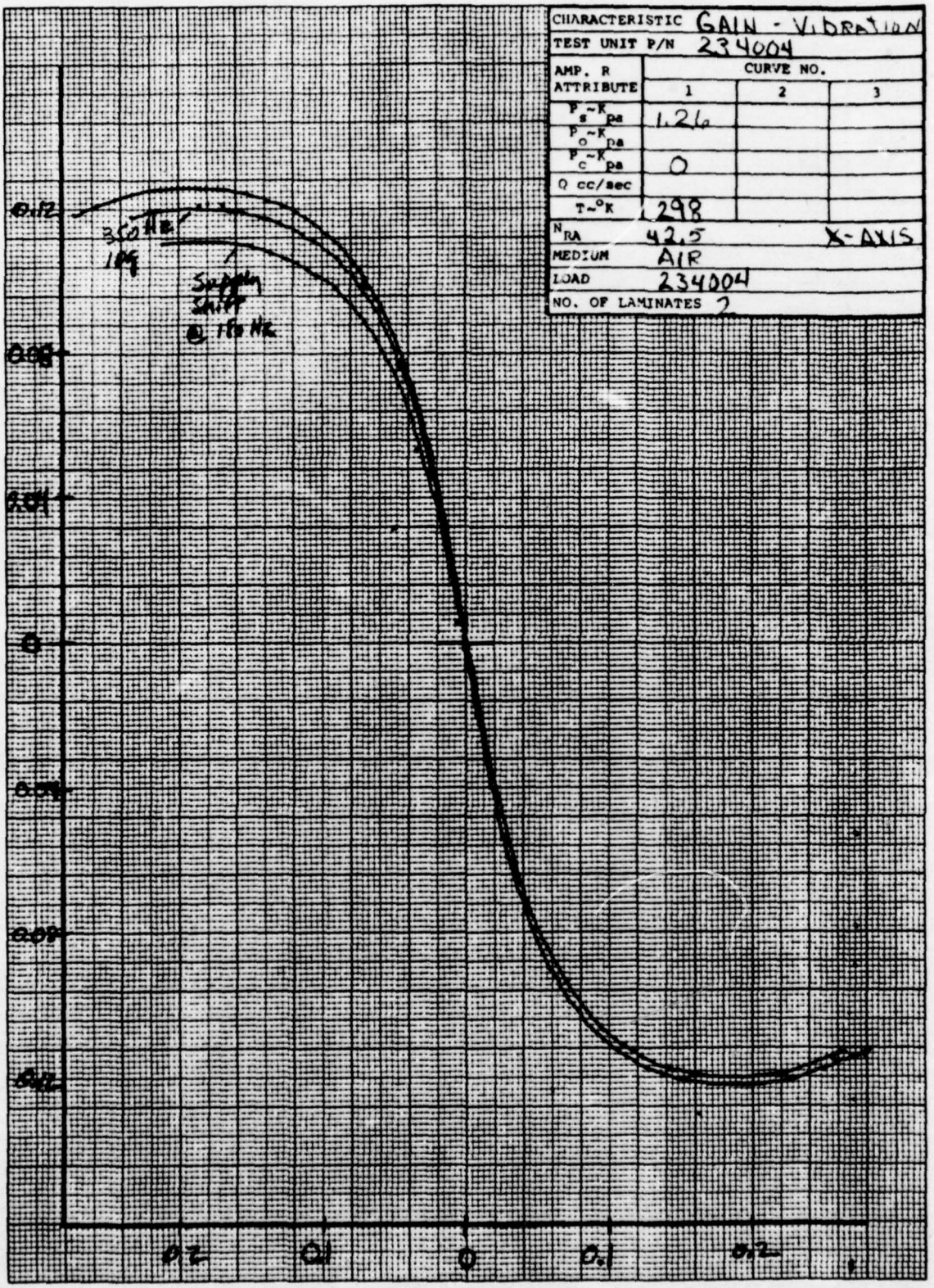

CHARACTERISTIC GAIN Vib
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
1.26
$P_o$~K pa
$P_c$~K pa
Q cc/sec
T~°K
85°F
$N_{RA}$ 42.5
Y-AXIS
MEDIUM AIR
LOAD 231004A
NO. OF LAMINATES 2
ΔPo, kPa
0.12
0.04
0
0.12
0.1
0
0.01
0.12
ΔPc, kPa

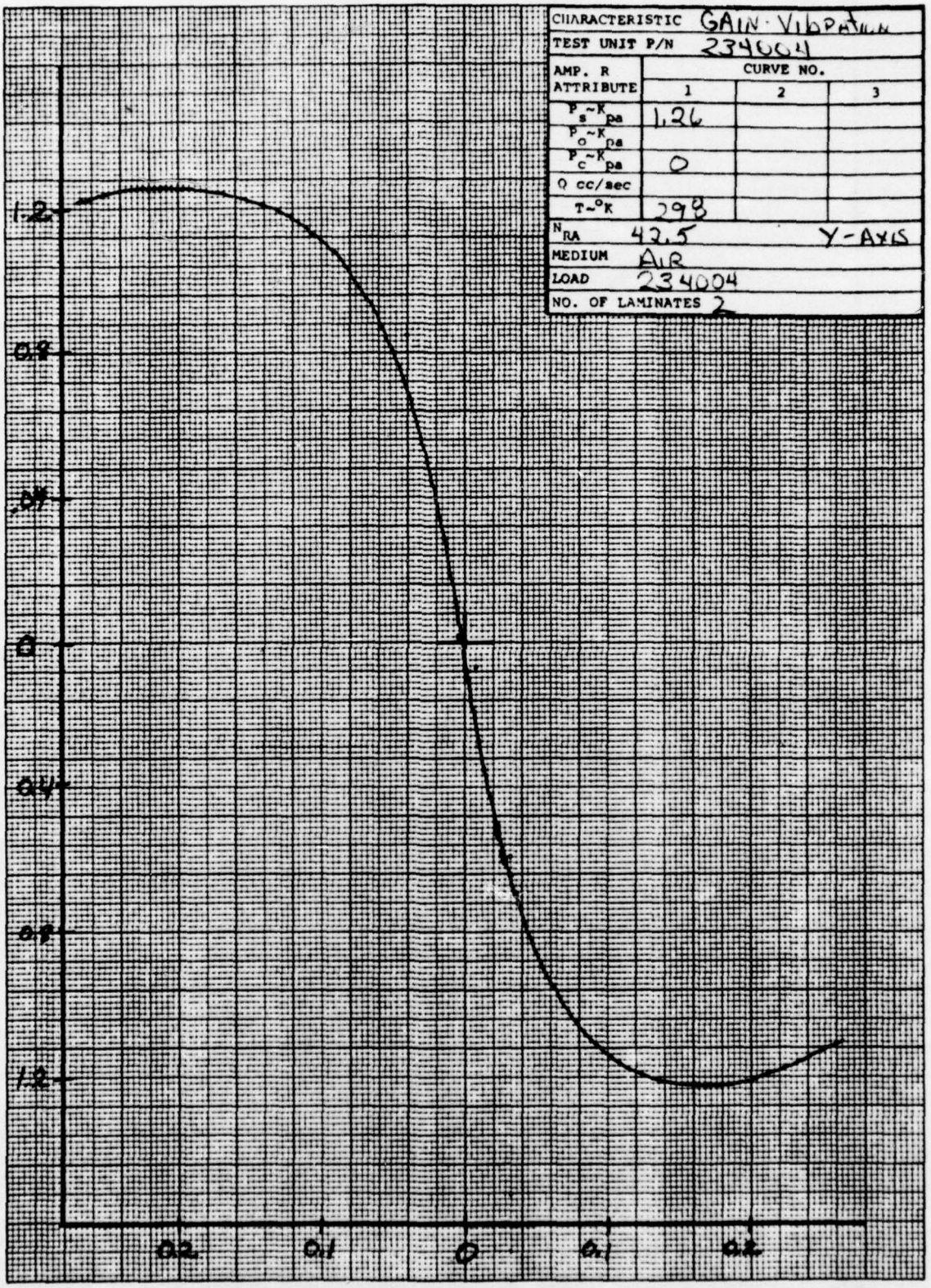

CHARACTERISTIC GAIN - VIBRATION
TEST UNIT P/N 231004L
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
1.26
$P_o$~K pa
$P_c$~K pa
0
Q cc/sec
T~°K
298
$N_{RA}$ 42.5
MEDIUM AIR
Z - AXIS
LOAD 231004
NO. OF LAMINATES 2
0.16
0.12
0.08
0.04
0
0.04
0.08
0.12
0.16
0.2
0.1
0
0.01
0.2
ΔPo, kPa
ΔPc, kPa

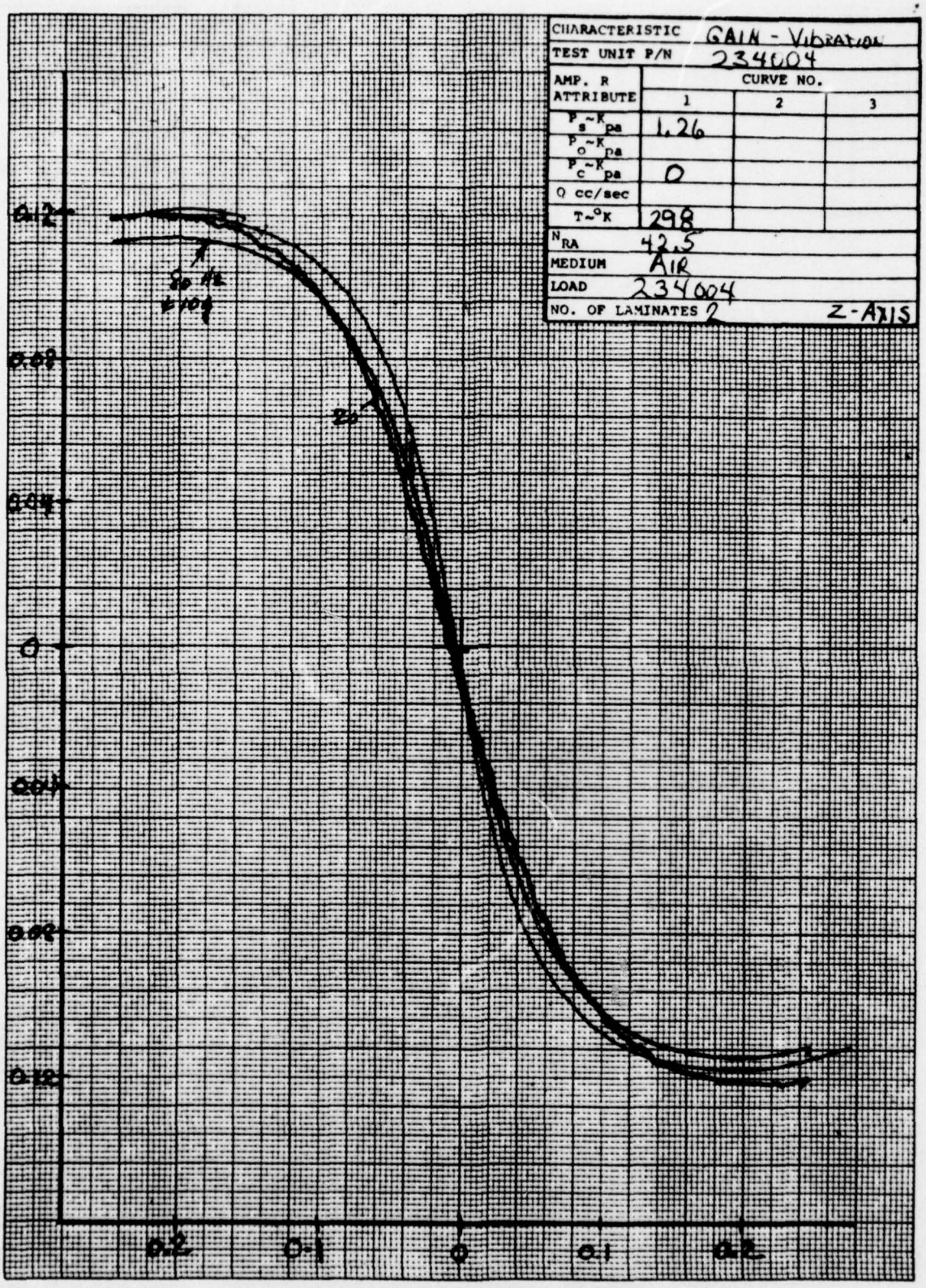

CHARACTERISTIC GAIN - VID
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
5.15
$P_o$~K pa
$P_c$~K pa
0
Q cc/sec
T~°K
293
$N_{RA}$
95
X-AXIS
MEDIUM
AIR
LOAD
234004
NO. OF LAMINATES 2
1.2
0.8
0.4
0
0.4
0.8
1.2
0.4
0.2
0
0.2
0.4
ΔPo, kPa
ΔPc, kPa

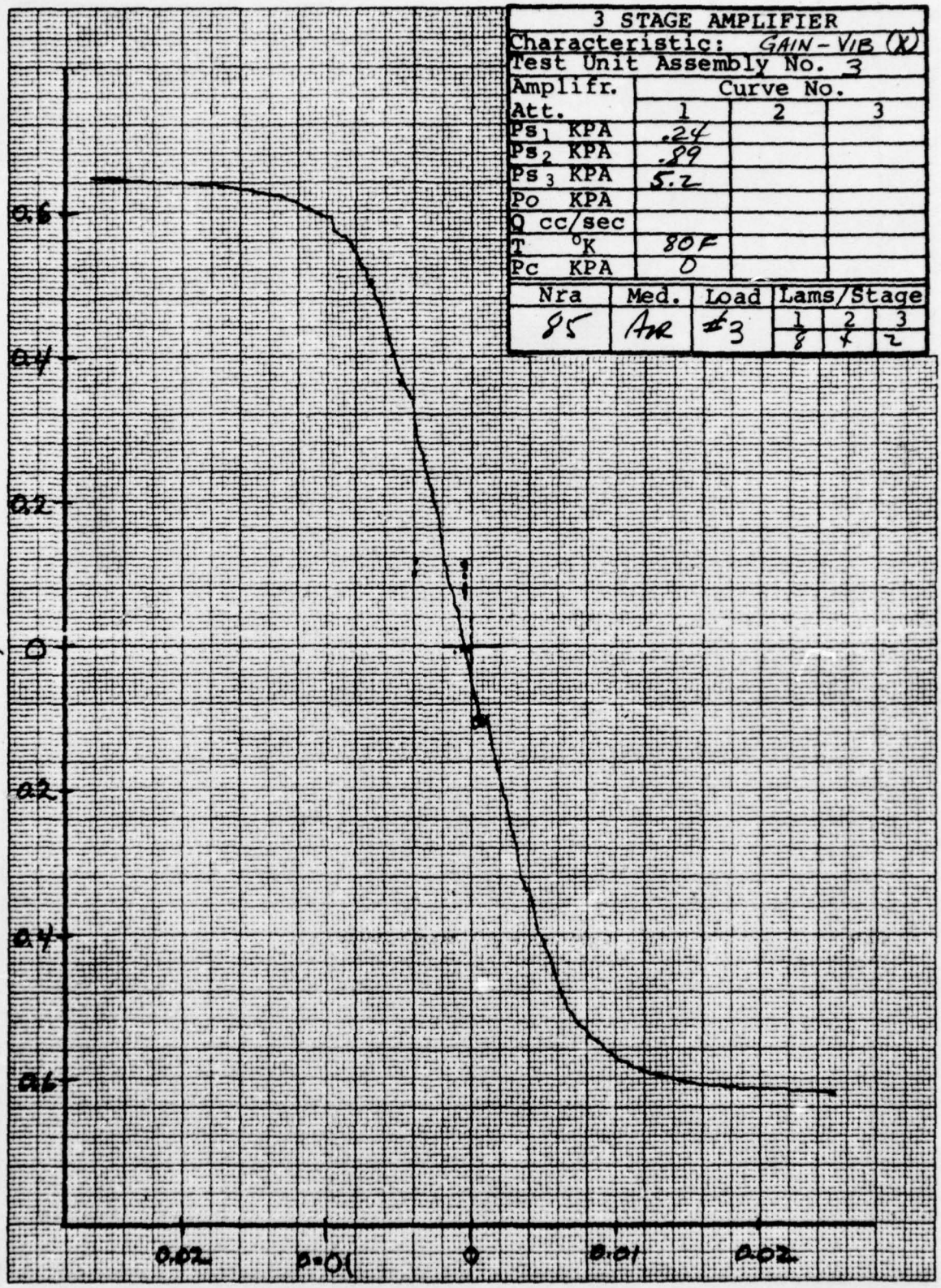

CHARACTERISTIC GAIN - VID.
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
5.15
$P_o$~K pa
$P_c$~K pa
0
Q cc/sec
T~°K
298
296°
$N_{RA}$ 85
Y-AXIS
MEDIUM
LOAD 234
NO. OF LAMINATES 2
ΔPo, kPa
0.8
0.4
0
0.4
0.8
0.4
0.2
0
0.2
0.4
ΔPc, kPa

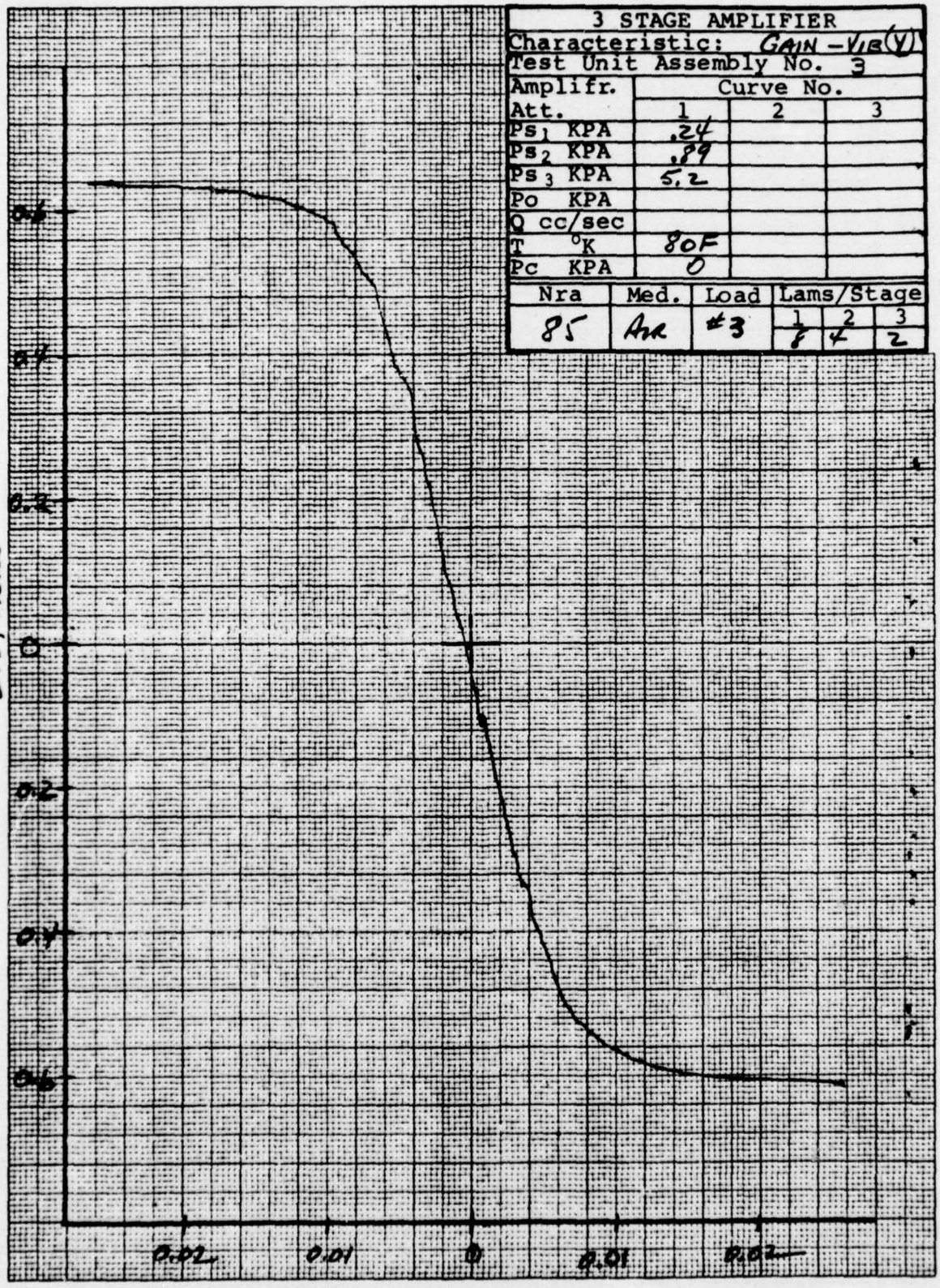

CHARACTERISTIC GAIN - V16
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
5.15
$P_o$~K pa
$P_c$~K pa
0
Q cc/sec
T~°K
298
$N_{RA}$
95
MEDIUM
AIR
LOAD
234
NO. OF LAMINATES 2
Z-AXIS
ΔPo, kPa
0.4
0.2
0
0.2
0.4
ΔPc, kPa

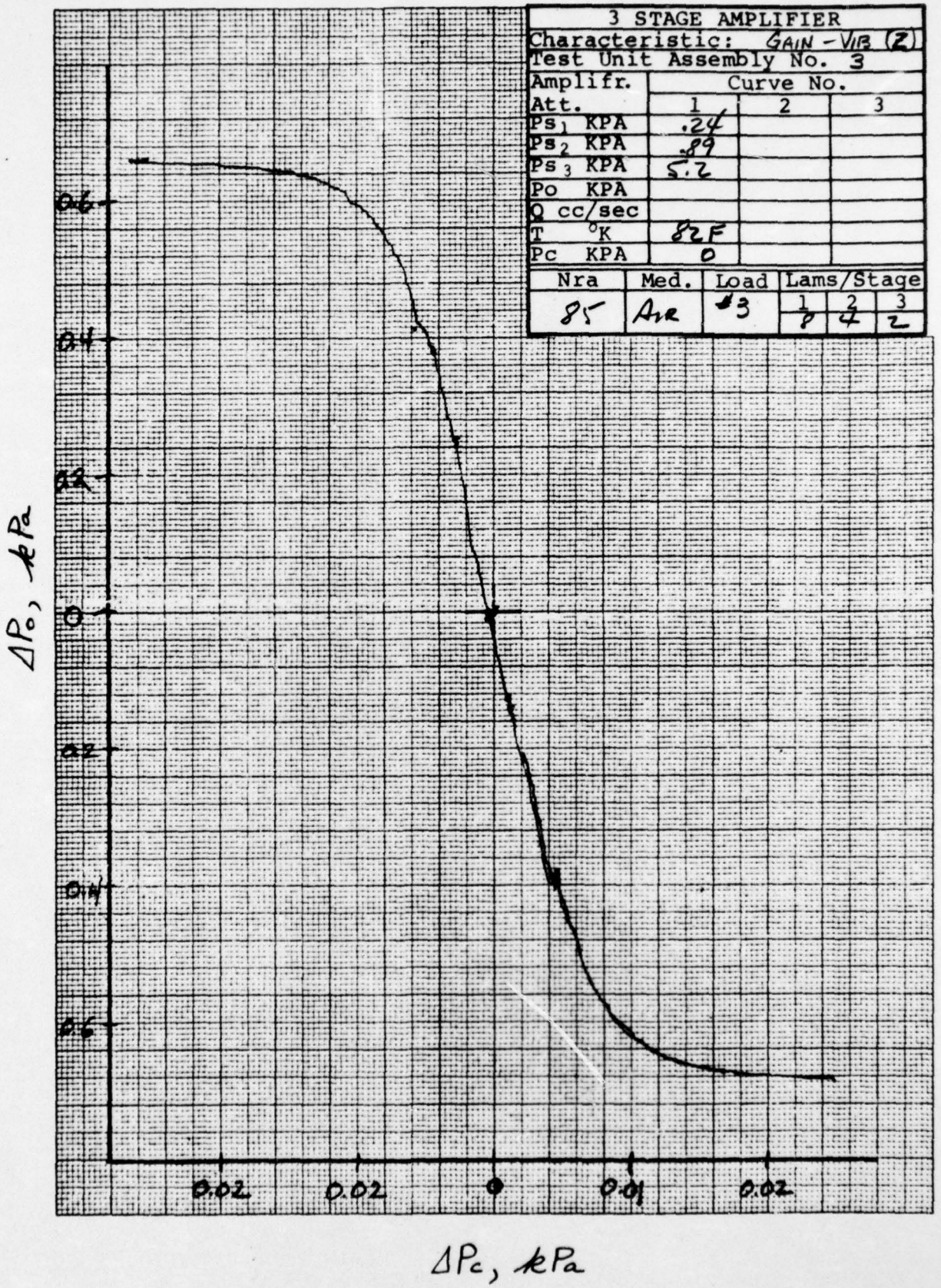

CHARACTERISTIC GAIN - VIBRATION
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K Pa 1.26
$P_o$~K Pa
$P_c$~K Pa 0
Q cc/sec
T~°K 298
$N_{RA}$ 42.5
X-AXIS
MEDIUM AIR
LOAD 234004
NO. OF LAMINATES 2
350 Hz
Shift @ 150 Hz
0.12
0.08
0.04
0
0.04
0.08
0.12
0.2
0.1
0
0.1
0.2
ΔPo, kPa
ΔPc, kPa

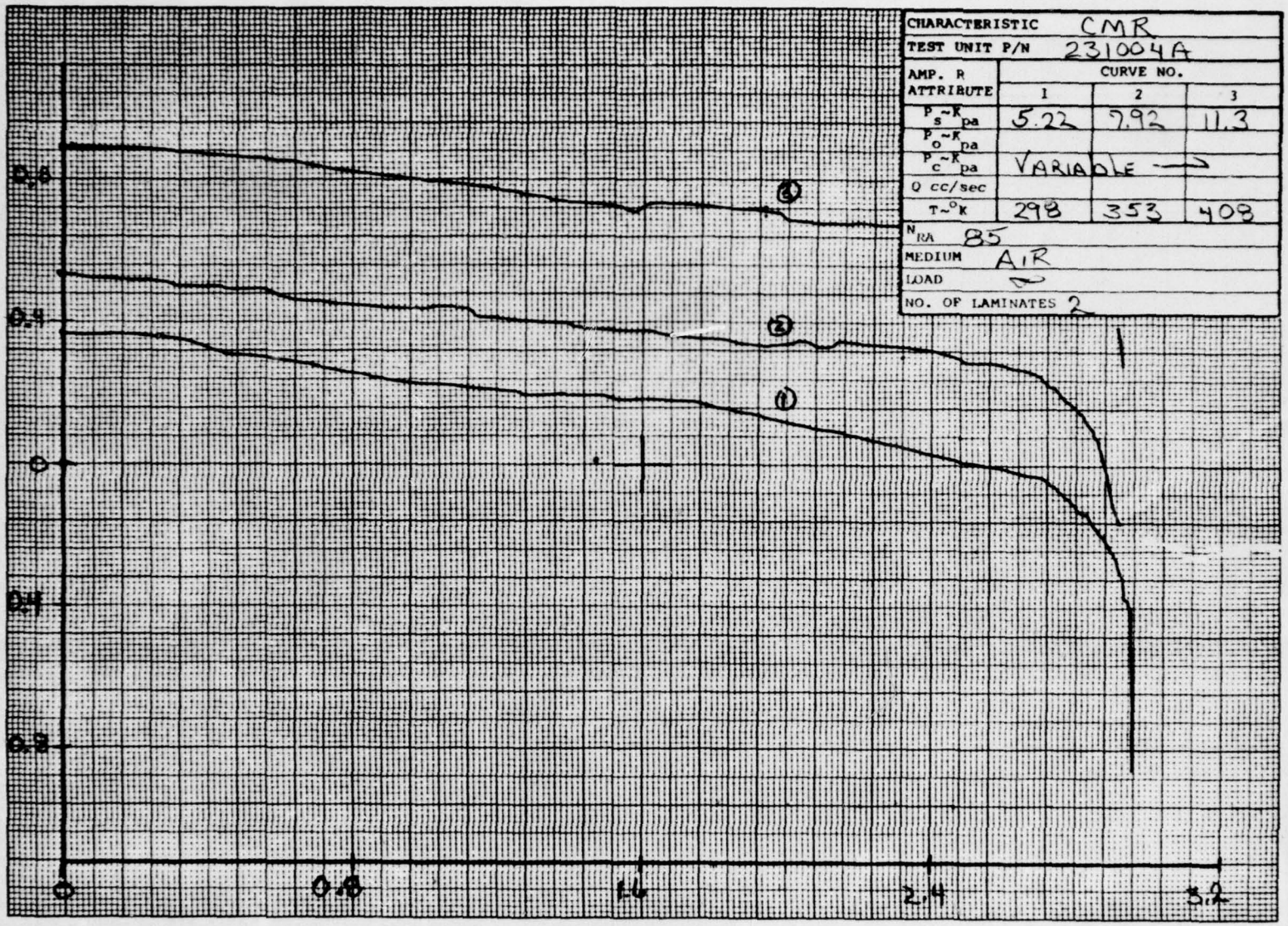

CHARACTERISTIC GAIN-VIBRATION
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
1.26
$P_o$~K pa
$P_c$~K pa
0
Q cc/sec
T-°K
298
$N_{RA}$ 42.5
Y-AXIS
MEDIUM AIR
LOAD 234004
NO. OF LAMINATES 2
1.2
0.8
.04
0
0.4
0.8
1.2
0.2
0.1
0
0.1
0.2
ΔPo, kPa
ΔPc, kPa


CHARACTERISTIC GAIN - VIBRATION
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa 1.26
$P_o$~K pa
$P_c$~K pa 0
Q cc/sec
T~°K 298
$N_{RA}$ 42.5
MEDIUM AIR
LOAD 234004
NO. OF LAMINATES 2
Z-AXIS
0.12
0.08
0.04
0
0.04
0.08
0.12
0.2
0.1
0
0.1
0.2
ΔPo, kPa
ΔPc, kPa


3 STAGE AMPLIFIER
Characteristic: GAIN - VIB (X)
Test Unit Assembly No. 3
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .24
Ps2 KPA .89
Ps3 KPA 5.2
Po KPA
Q cc/sec
T °K 80F
Pc KPA 0
Nra 85
Med. Air
Load #3
Lams/Stage 1/8 2/4 3/2
0.6
0.4
0.2
0
0.2
0.4
0.6
ΔPo, kPa
0.02
0.01
0
0.01
0.02
ΔPc, kPa

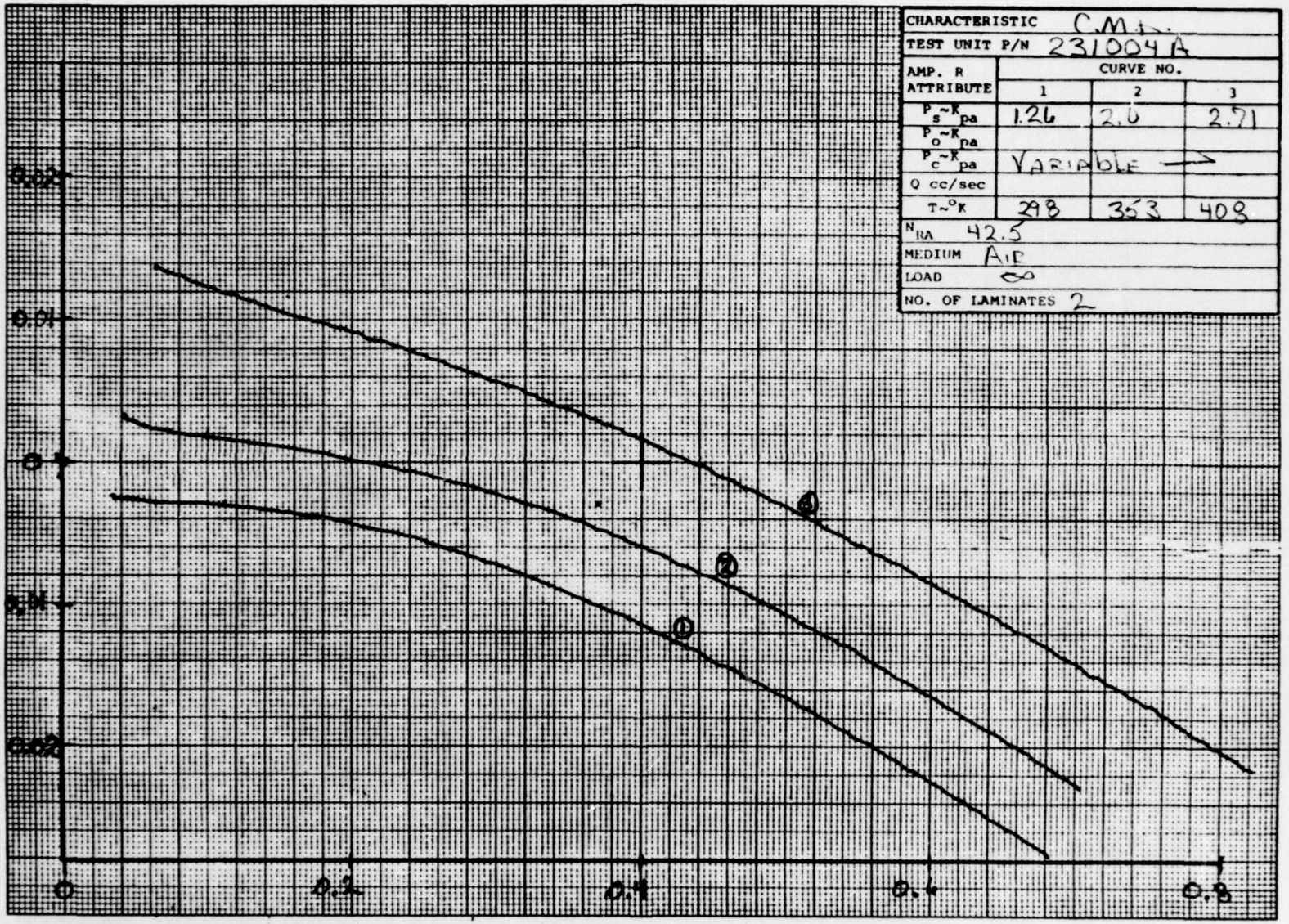

3 STAGE AMPLIFIER
Characteristic: GAIN - VIB(V)
Test Unit Assembly No. 3
Amplifr. Att. | Curve No. 1 | 2 | 3
Ps1 KPA | .24
Ps2 KPA | .89
Ps3 KPA | 5.2
Po KPA
Q cc/sec
T °K | 80F
Pc KPA | 0
Nra | Med. | Load | Lams/Stage 1 | 2 | 3
85 | Air | #3 | 1 | 4 | 2
ΔPo, kPa
0.6
0.4
0.2
0
0.2
0.4
0.6
0.02
0.01
0
0.01
0.02
ΔPc, kPa

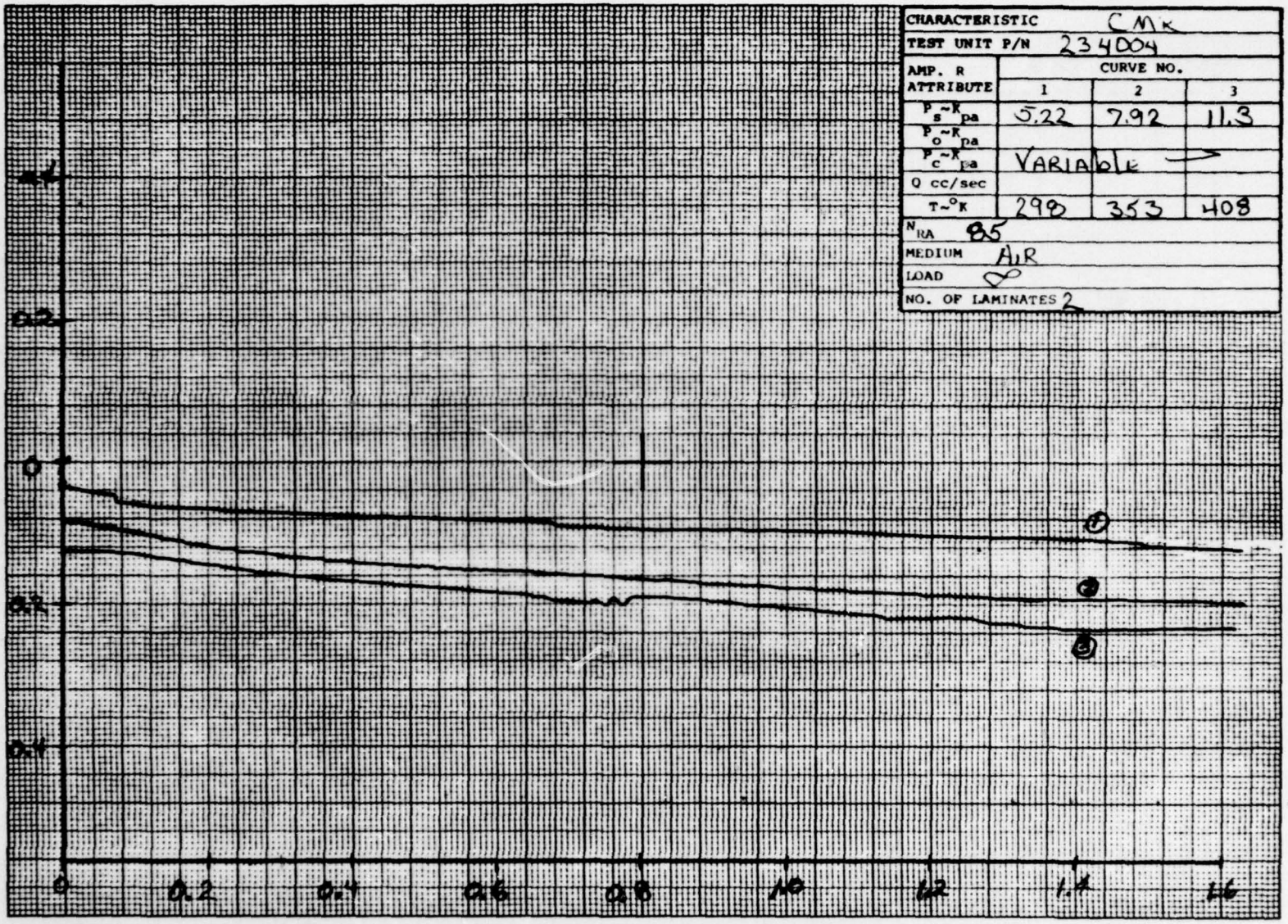

3 STAGE AMPLIFIER
Characteristic: GAIN - VIB (Z)
Test Unit Assembly No. 3
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .24
Ps2 KPA .89
Ps3 KPA 5.2
Po KPA
Q cc/sec
T °K 82F
Pc KPA 0
Nra 85
Med. Air
Load #3
Lams/Stage 1 8 2 4 3 2
0.6
0.4
0.2
0
0.2
0.4
0.6
ΔPo, kPa
0.02
0.02
0
0.01
0.02
ΔPc, kPa

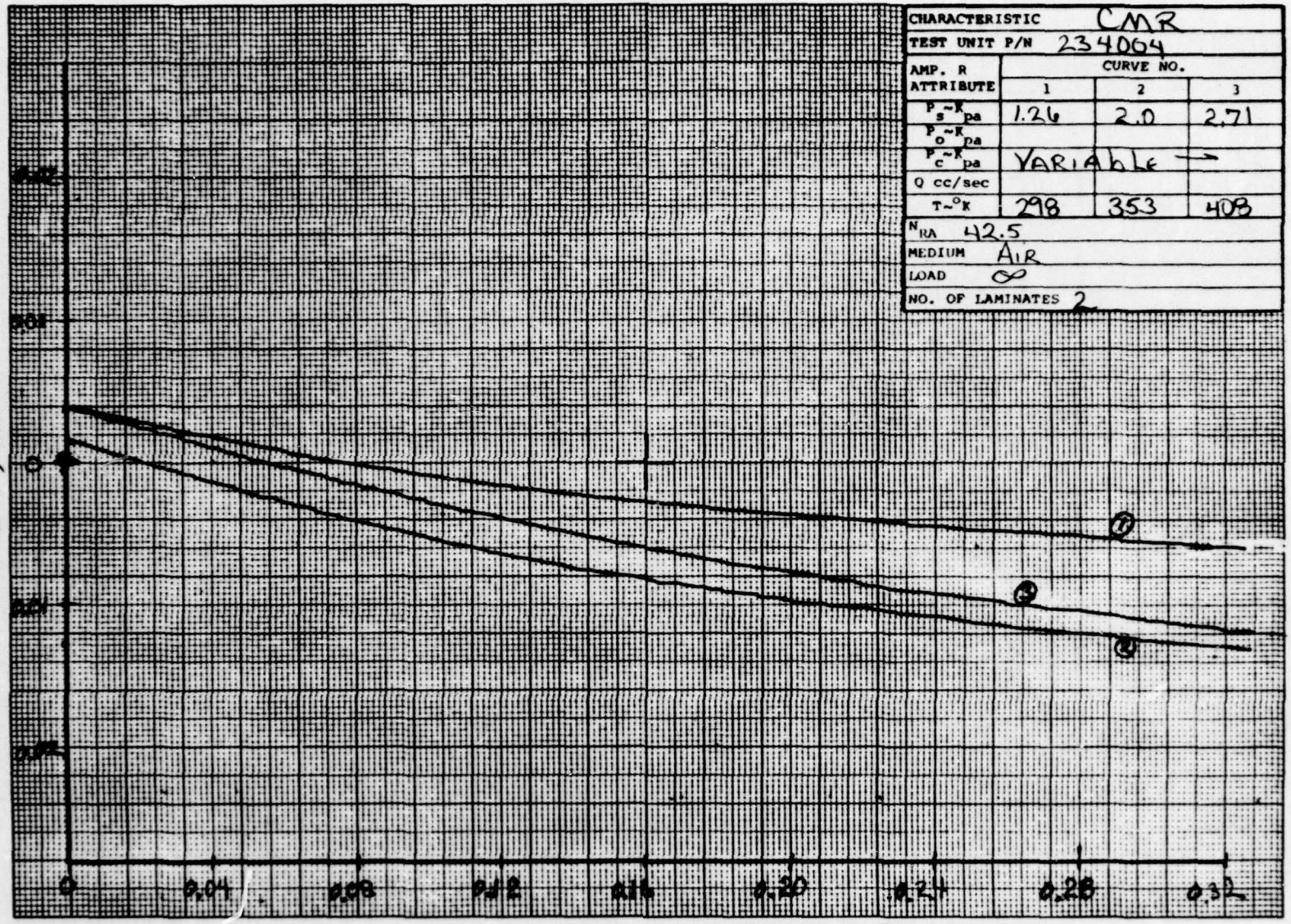


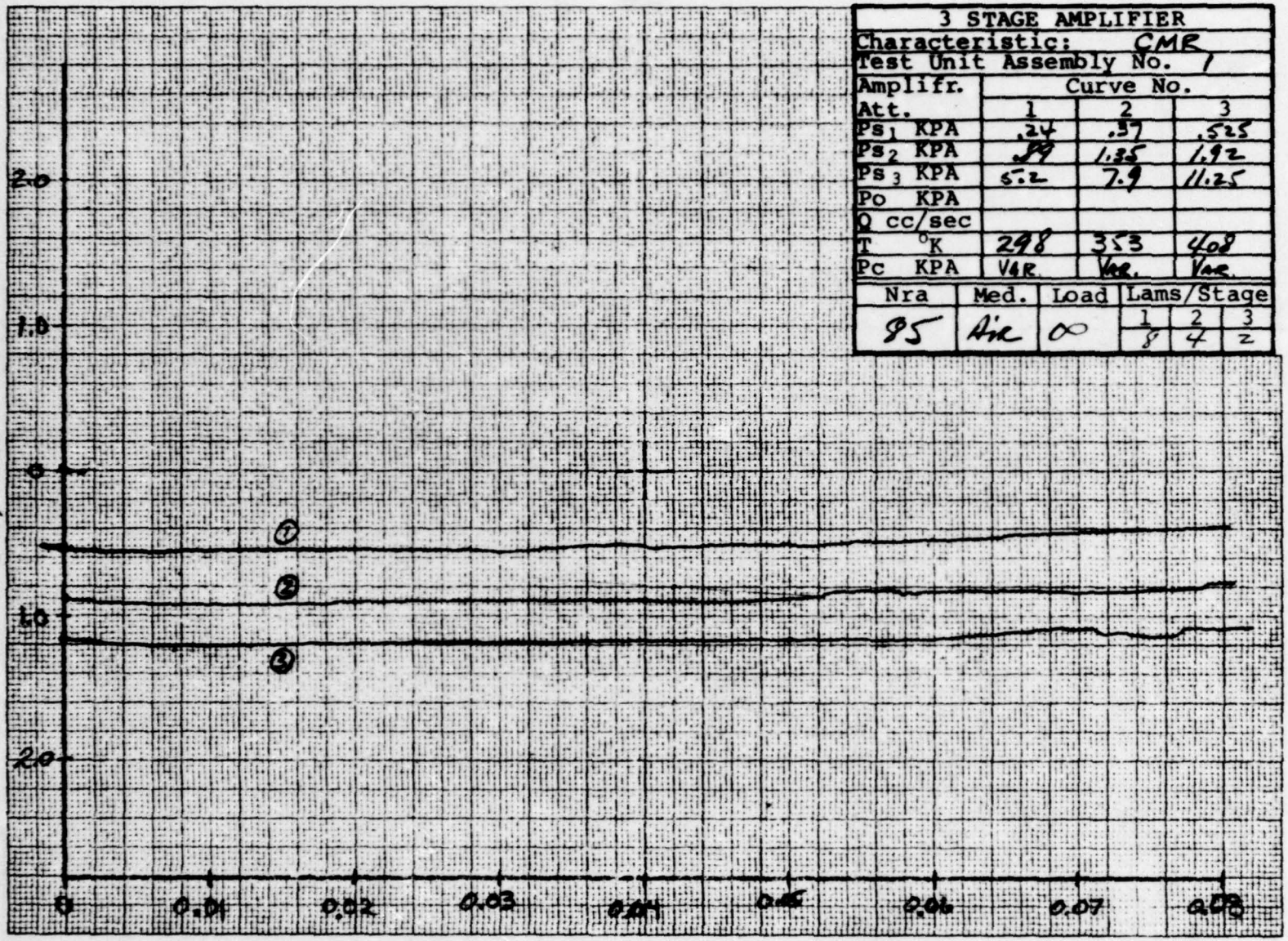



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CHARACTERISTIC C.M.
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa 1.26 2.0 2.71
$P_o$~Kpa
$P_c$~Kpa VARIABLE →
Q cc/sec
T~°K 298 353 408
$N_{RA}$ 42.5
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
0.02
0.01
0.1
0.04
0.02
0
0.2
0.4
0.6
0.8
ΔPo, kPa
P̄c, kPa
300

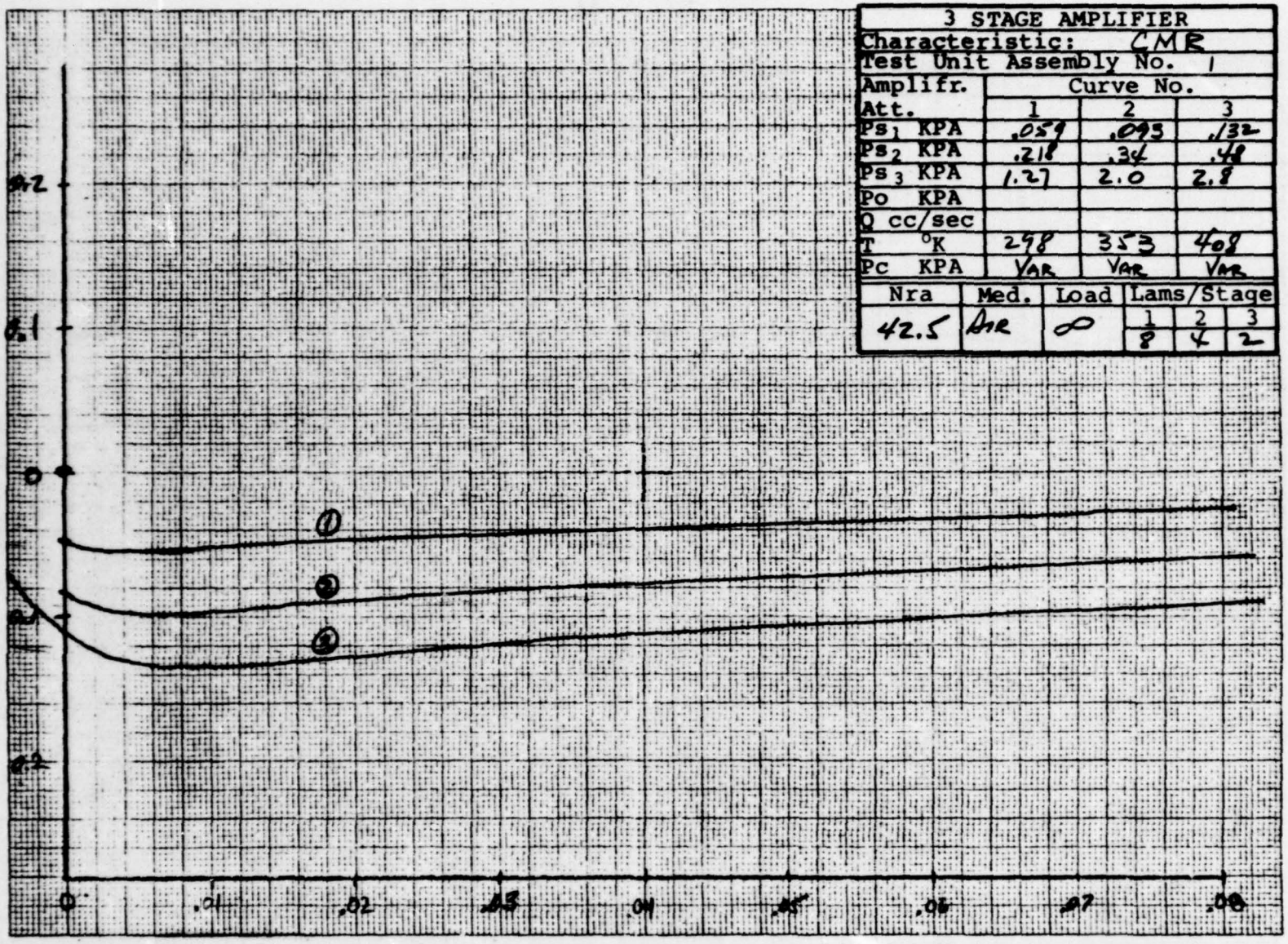

CHARACTERISTIC CMK
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa 5.22 7.92 11.3
$P_o$~K pa
$P_c$~K pa VARIABLE →
Q cc/sec
T~°K 298 353 408
$N_{RA}$ 85
MEDIUM AIR
LOAD
NO. OF LAMINATES 2
ΔPo, kPa
0.4
0.2
0
0.2
0.4
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
$\bar{P}_c$, kPa


CHARACTERISTIC CMR
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1 2 3
$P_s$~K pa 1.26 2.0 2.71
$P_o$~K pa
$P_c$~K pa VARIABLE →
Q cc/sec
T~°K 298 353 408
$N_{RA}$ 42.5
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
ΔPo, kPa
0
0.04
0.08
0.12
0.16
0.20
0.24
0.28
0.32
Pc, kPa

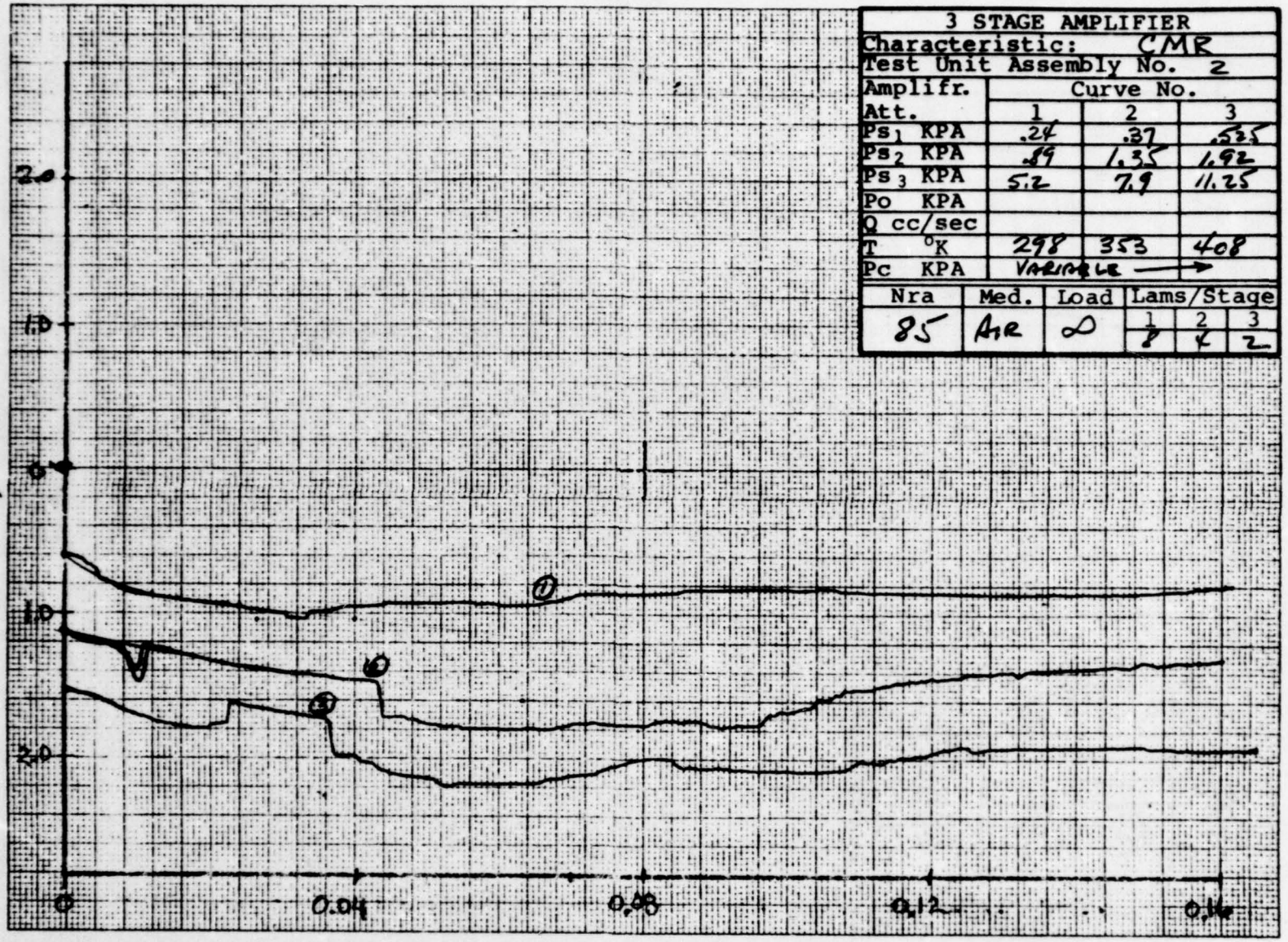


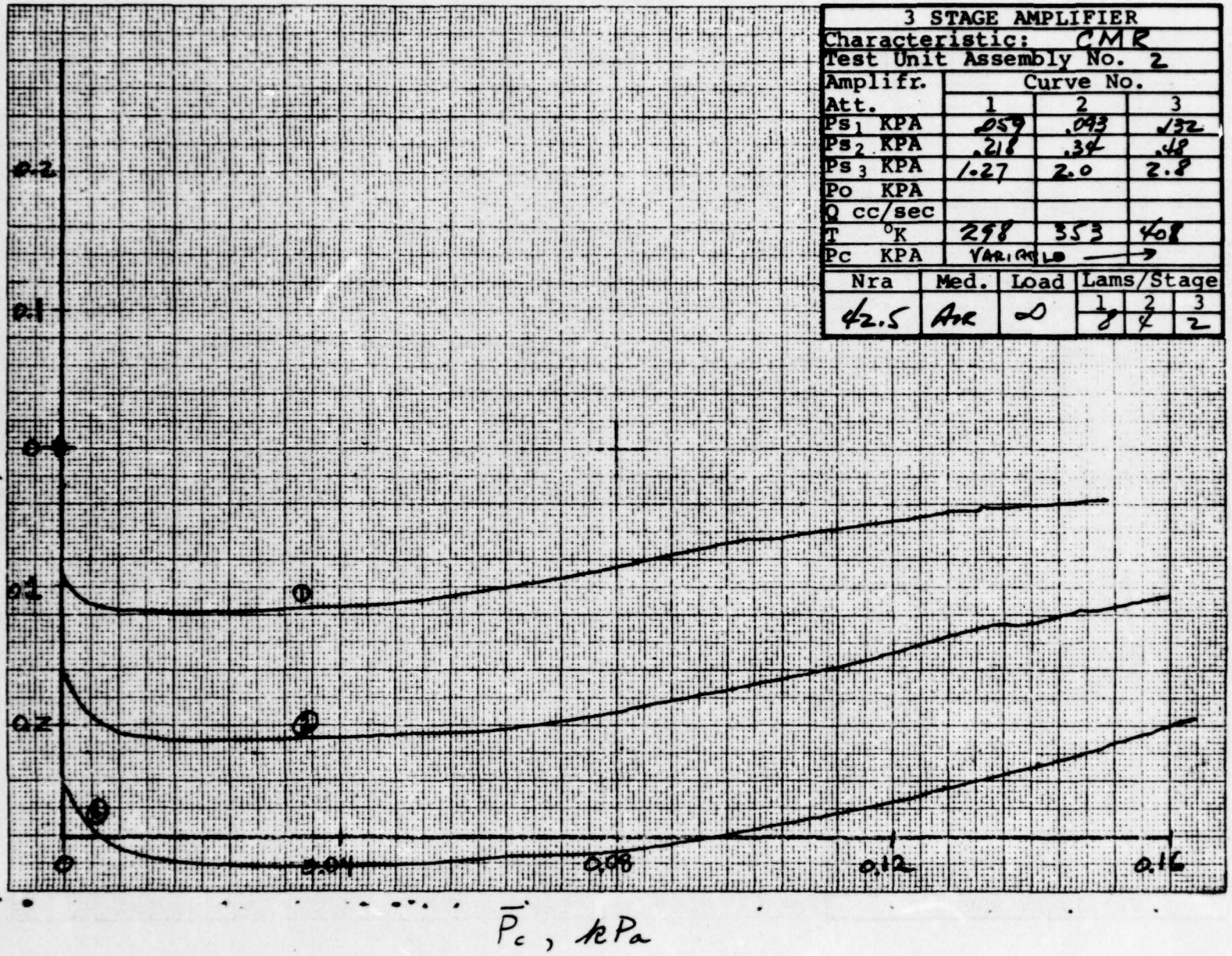

| 3 STAGE AMPLIFIER | | | |
|---|---|---|---|
| Characteristic: CMR | | | |
| Test Unit Assembly No. 1 | | | |
| Amplifr. Att. | Curve No. 1 | 2 | 3 |
| $Ps_1$ KPA | .24 | .57 | .525 |
| $Ps_2$ KPA | .89 | 1.35 | 1.92 |
| $Ps_3$ KPA | 5.2 | 7.9 | 11.25 |
| Po KPA | | | |
| Q cc/sec | | | |
| T °K | 298 | 353 | 408 |
| Pc KPA | Var. | Var. | Var. |

| Nra | Med. | Load | Lams/Stage 1 | 2 | 3 |
|---|---|---|---|---|---|
| 95 | Air | ∞ | 8 | 4 | 2 |

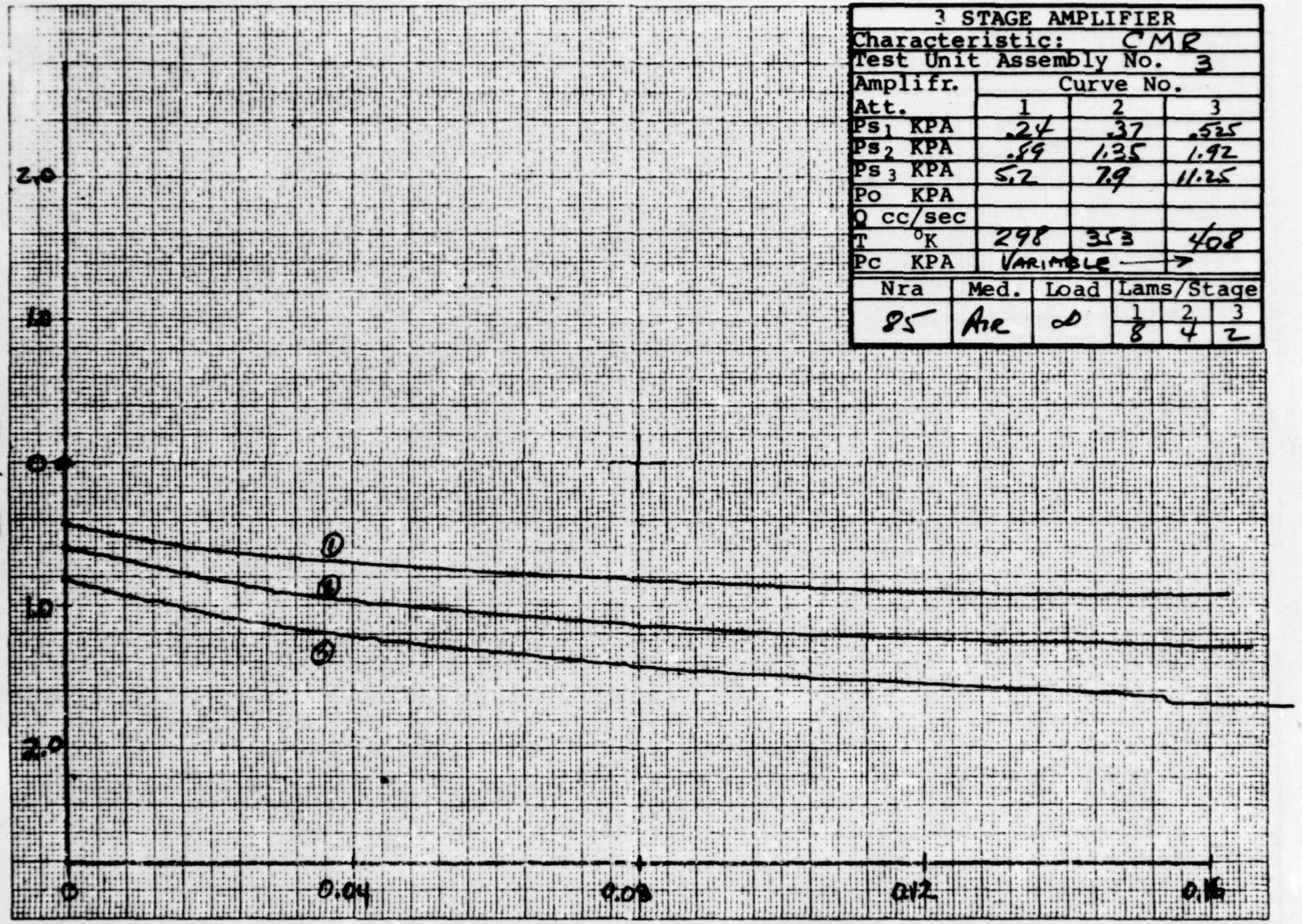

3 STAGE AMPLIFIER
Characteristic: CMR
Test Unit Assembly No. 1
Amplifr. Att. | Curve No. 1 | 2 | 3
Ps1 KPA | .059 | .095 | .132
Ps2 KPA | .218 | .34 | .48
Ps3 KPA | 1.27 | 2.0 | 2.8
Po KPA
Q cc/sec
T °K | 298 | 353 | 408
Pc KPA | VAR | VAR | VAR
Nra | Med. | Load | Lams/Stage 1 | 2 | 3
42.5 | Air | ∞ | 8 | 4 | 2
ΔPo, kPa
0.2
0.1
0
-0.2
1
2
3
0
.01
.02
.03
.04
.05
.07
.08
P̄c, kPa

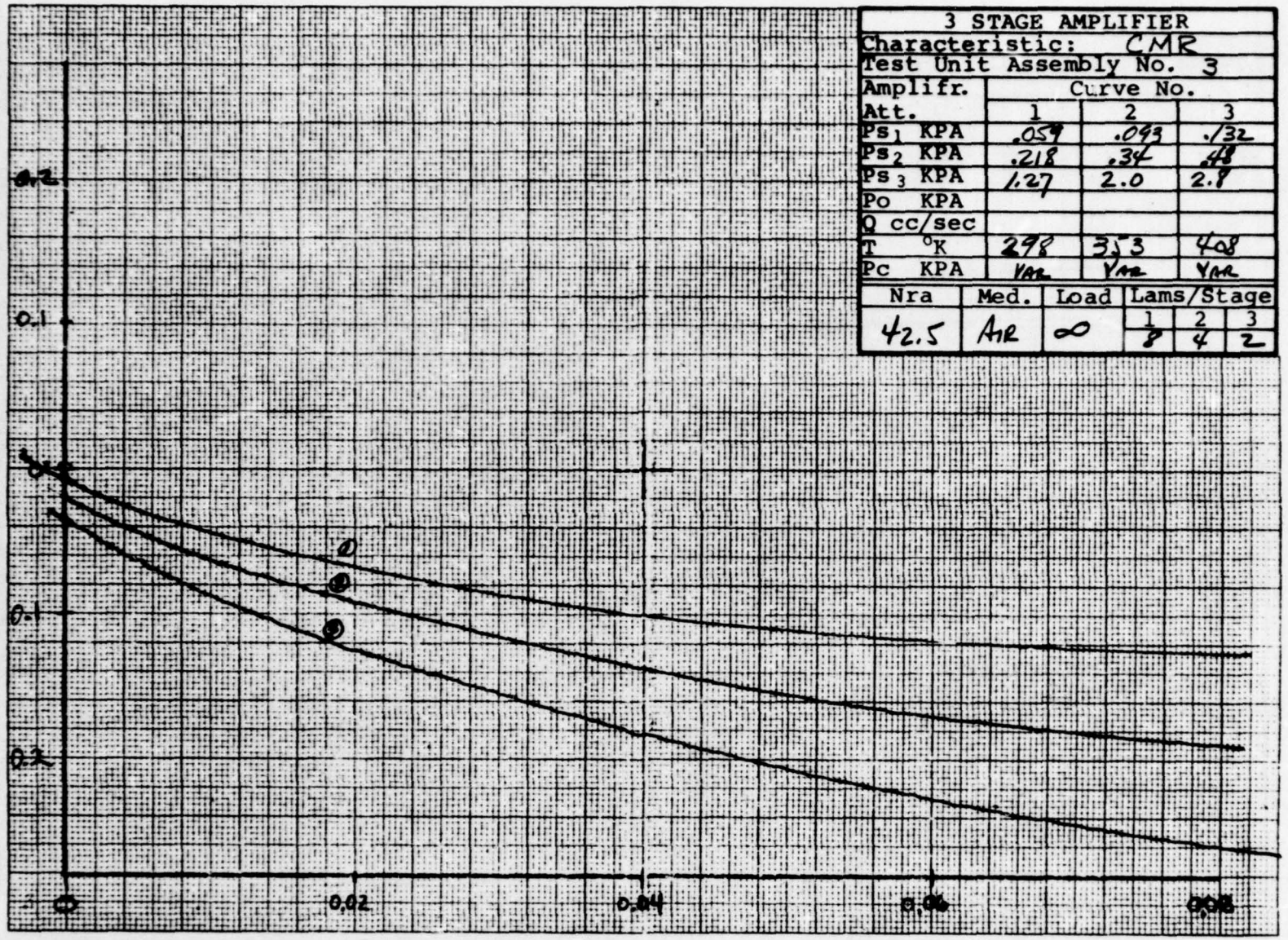
304


3 STAGE AMPLIFIER
Characteristic: CMR
Test Unit Assembly No. 2
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .24 .37 .525
Ps2 KPA .89 1.35 1.92
Ps3 KPA 5.2 7.9 11.25
Po KPA
Q cc/sec
T °K 298 353 408
Pc KPA VARIABLE →
Nra 85
Med. AIR
Load ∞
Lams/Stage 1/8 2/4 3/2
2.0
1.0
0
1.0
2.0
0
0.04
0.08
0.12
0.16
ΔPo, kPa
P̄c, kPa

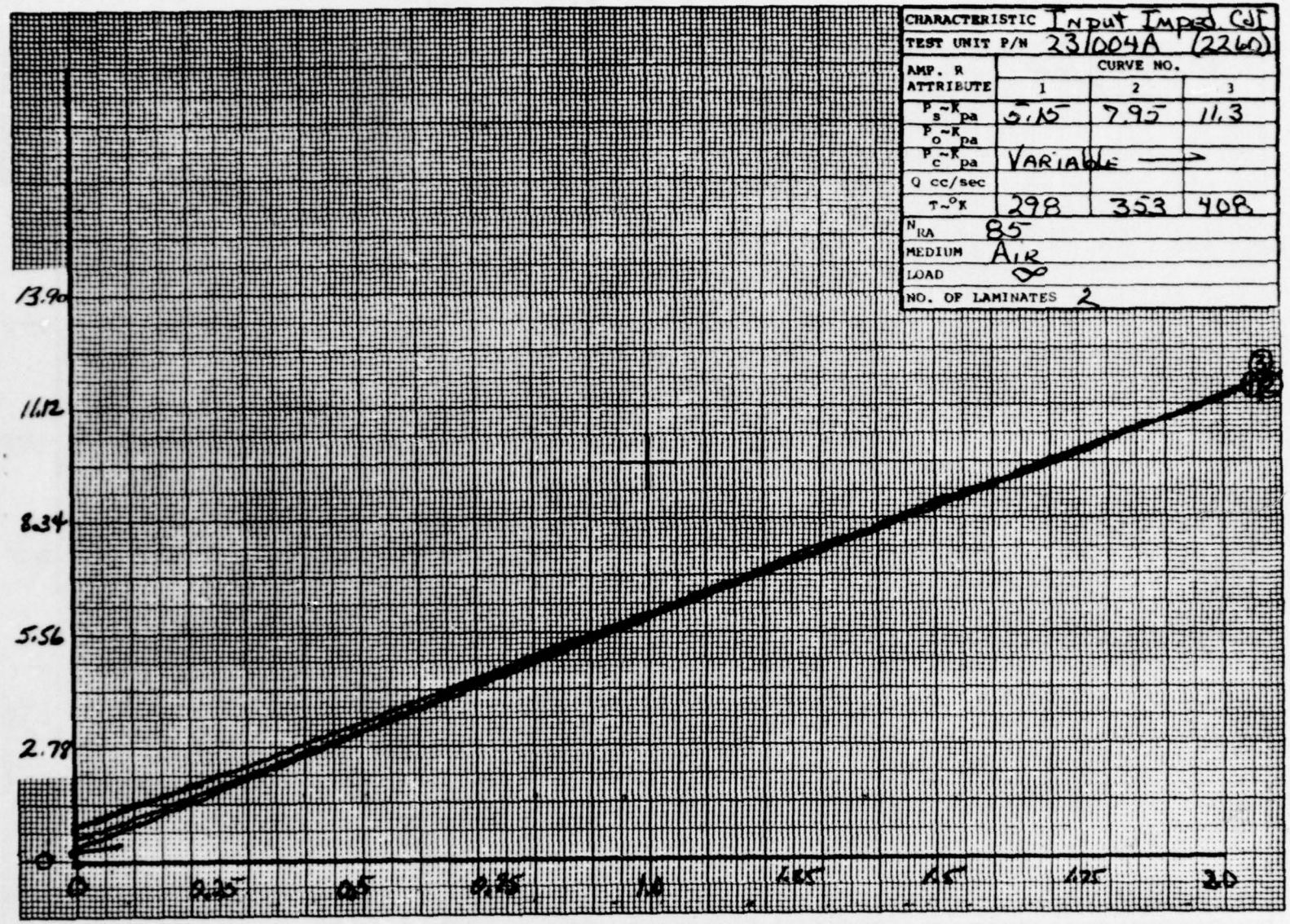


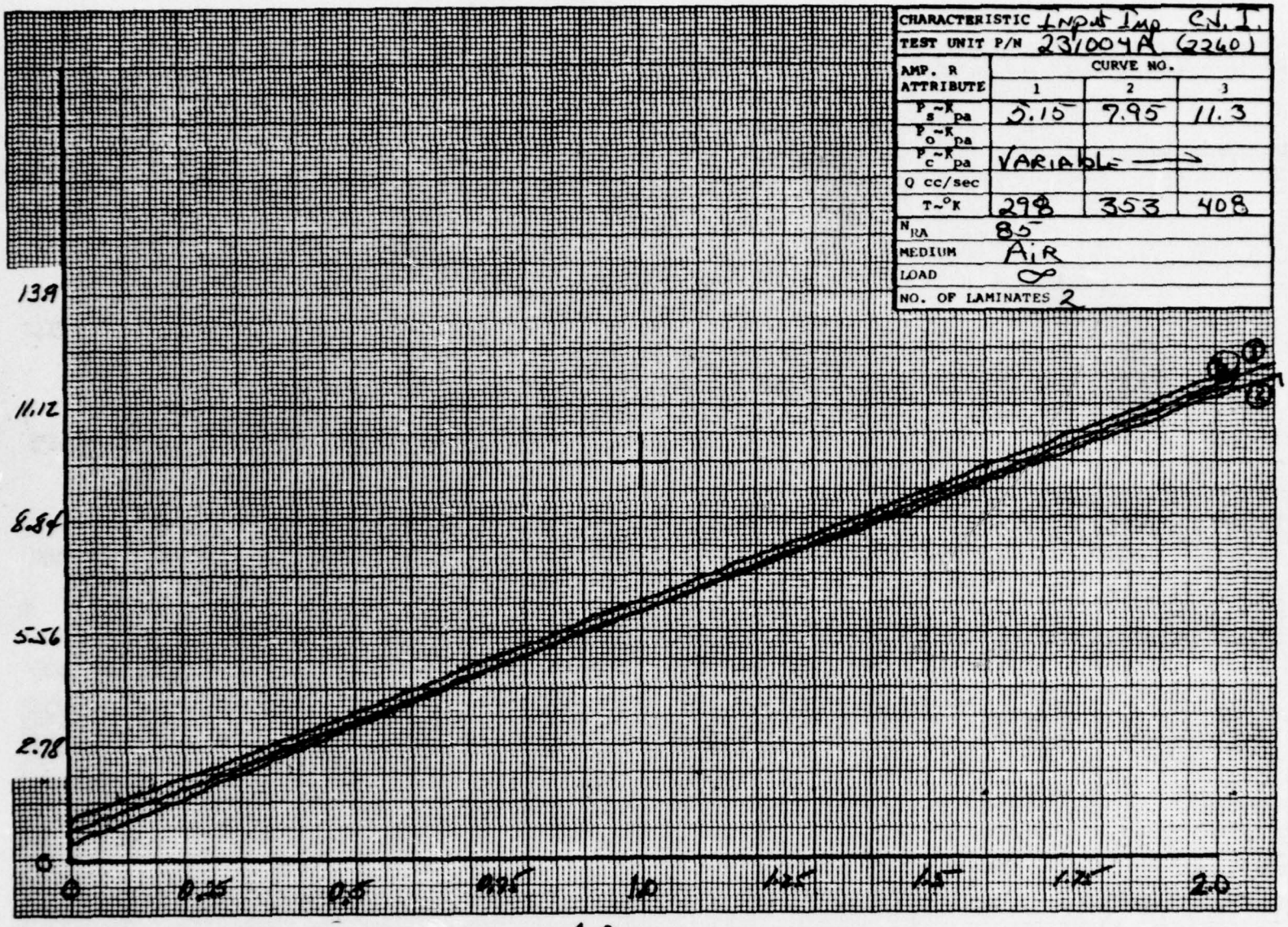

| 3 STAGE AMPLIFIER | | | | | |
|---|---|---|---|---|---|
| Characteristic: CMR | | | | | |
| Test Unit Assembly No. 2 | | | | | |
| Amplifr. Att. | Curve No. | | | | |
| | 1 | 2 | 3 | | |
| $Ps_1$ KPA | .059 | .093 | .132 | | |
| $Ps_2$ KPA | .218 | .34 | .48 | | |
| $Ps_3$ KPA | 1.27 | 2.0 | 2.8 | | |
| Po KPA | | | | | |
| Q cc/sec | | | | | |
| T °K | 298 | 353 | 408 | | |
| Pc KPA | VARIABLE → | | | | |
| Nra | Med. | Load | Lams/Stage | | |
| | | | 1 | 2 | 3 |
| 42.5 | Air | ∞ | 8 | 4 | 2 |


3 STAGE AMPLIFIER
Characteristic: CMR
Test Unit Assembly No. 3
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .24 .37 .525
Ps2 KPA .89 1.35 1.92
Ps3 KPA 5.2 7.9 11.25
Po KPA
Q cc/sec
T °K 298 353 408
Pc KPA VARIABLE →
Nra 85
Med. Air
Load ∞
Lams/Stage 1/8 2/4 3/2
ΔPo, kPa
2.0
1.0
0
1.0
2.0
0
0.04
0.08
0.12
0.16
Pc, kPa

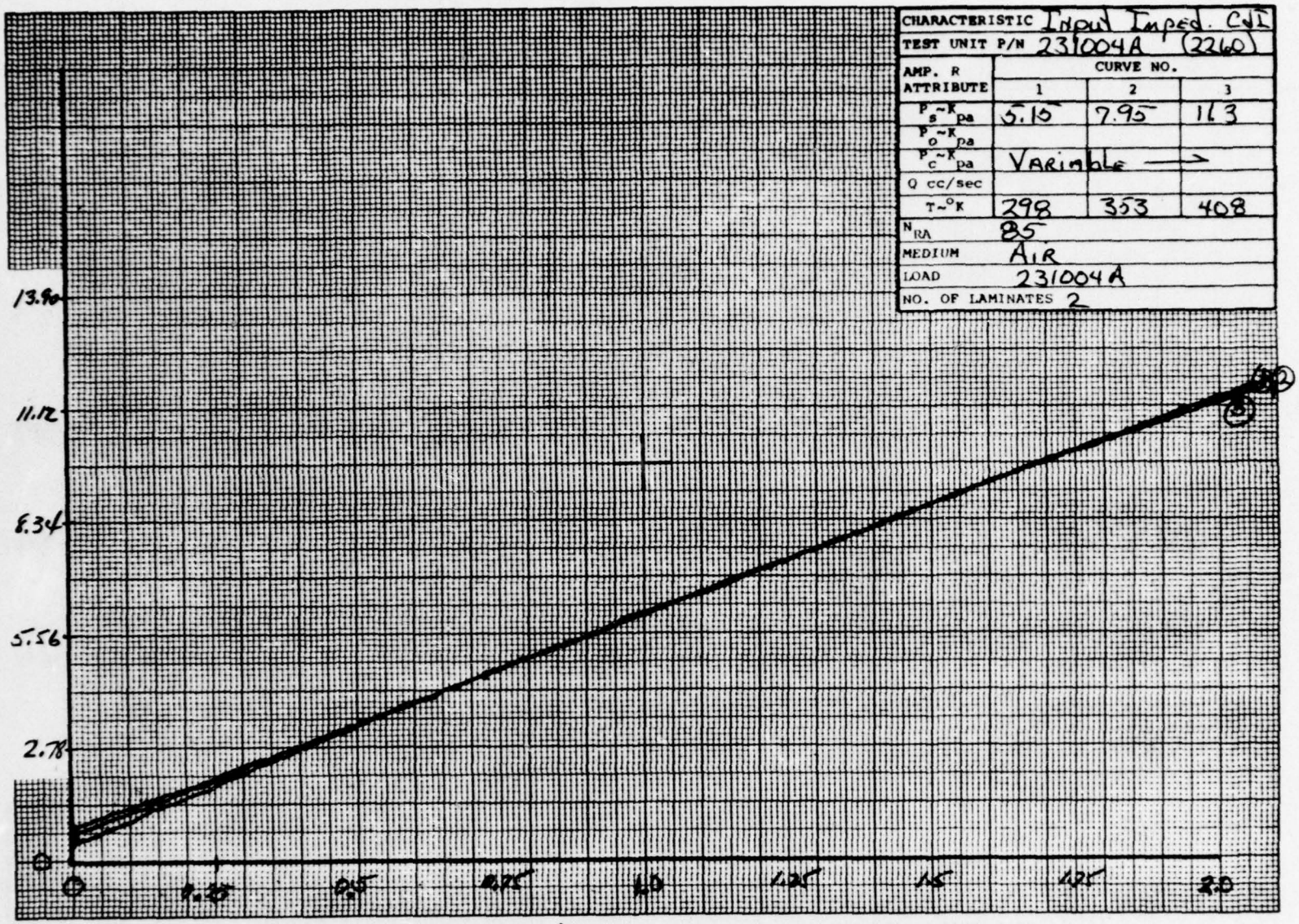

3 STAGE AMPLIFIER
Characteristic: CMR
Test Unit Assembly No. 3
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA .059 .093 .132
Ps2 KPA .218 .34 .48
Ps3 KPA 1.27 2.0 2.8
Po KPA
Q cc/sec
T °K 298 303 408
Pc KPA VAR VAR VAR
Nra 42.5
Med. AIR
Load ∞
Lams/Stage 1/8 2/4 3/2
ΔPo, kPa
0.2
0.1
0.1
0.2
0
0.02
0.04
0.06
0.08
P̄c, kPa

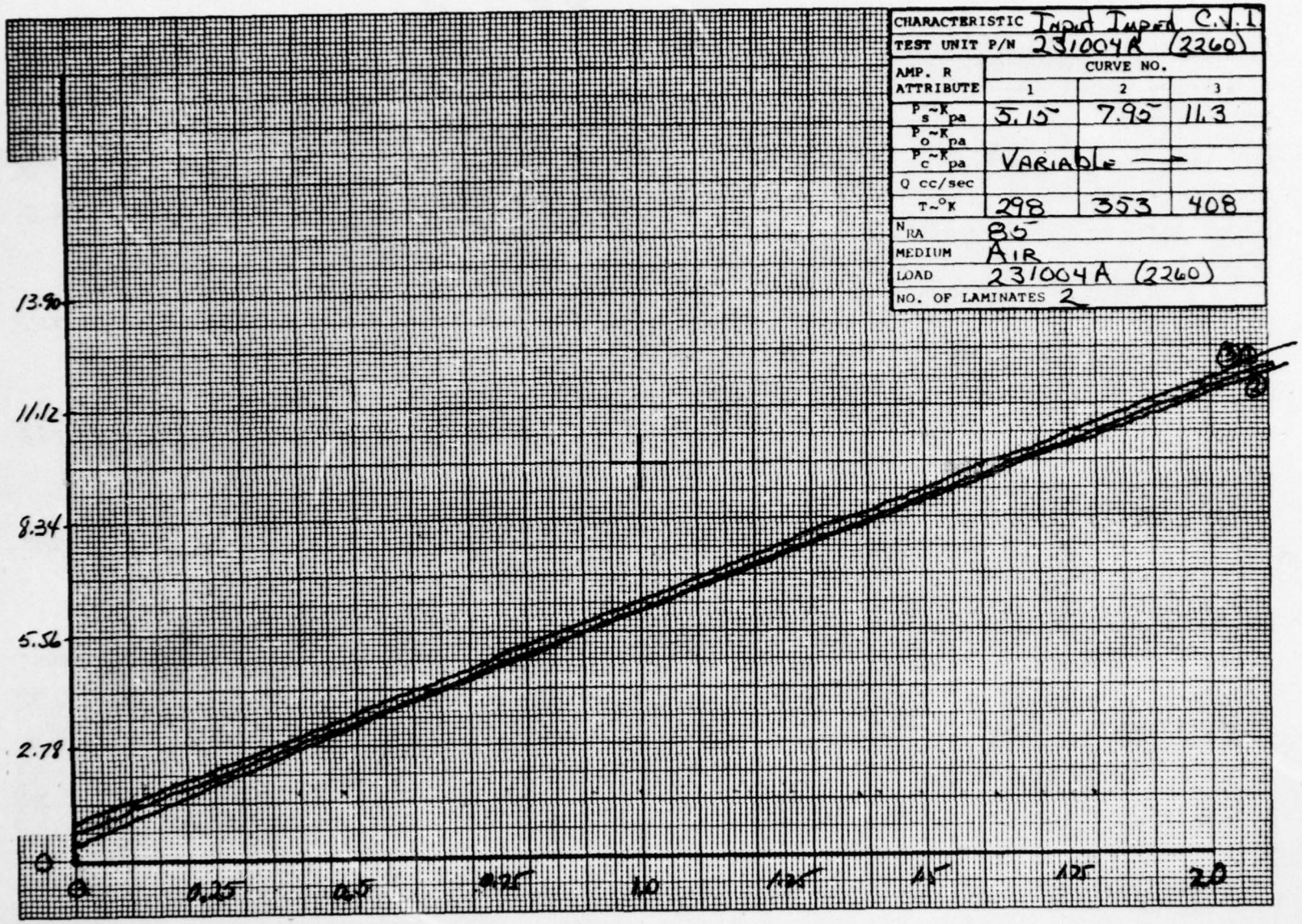
308


CHARACTERISTIC Input Impd. Cdt
TEST UNIT P/N 23/004A (2260)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~ K pa
5.15
7.95
11.3
$P_o$ ~ K pa
$P_c$ ~ K pa
VARIABLE →
Q cc/sec
T ~ °K
298
353
408
$N_{RA}$ 85
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
13.90
11.12
8.34
5.56
2.78
0
$Q_{C1}$, $m^3/sec \times 10^7$
0
0.25
0.5
0.75
1.0
1.25
1.5
1.75
2.0
$P_{C1}$, kPa

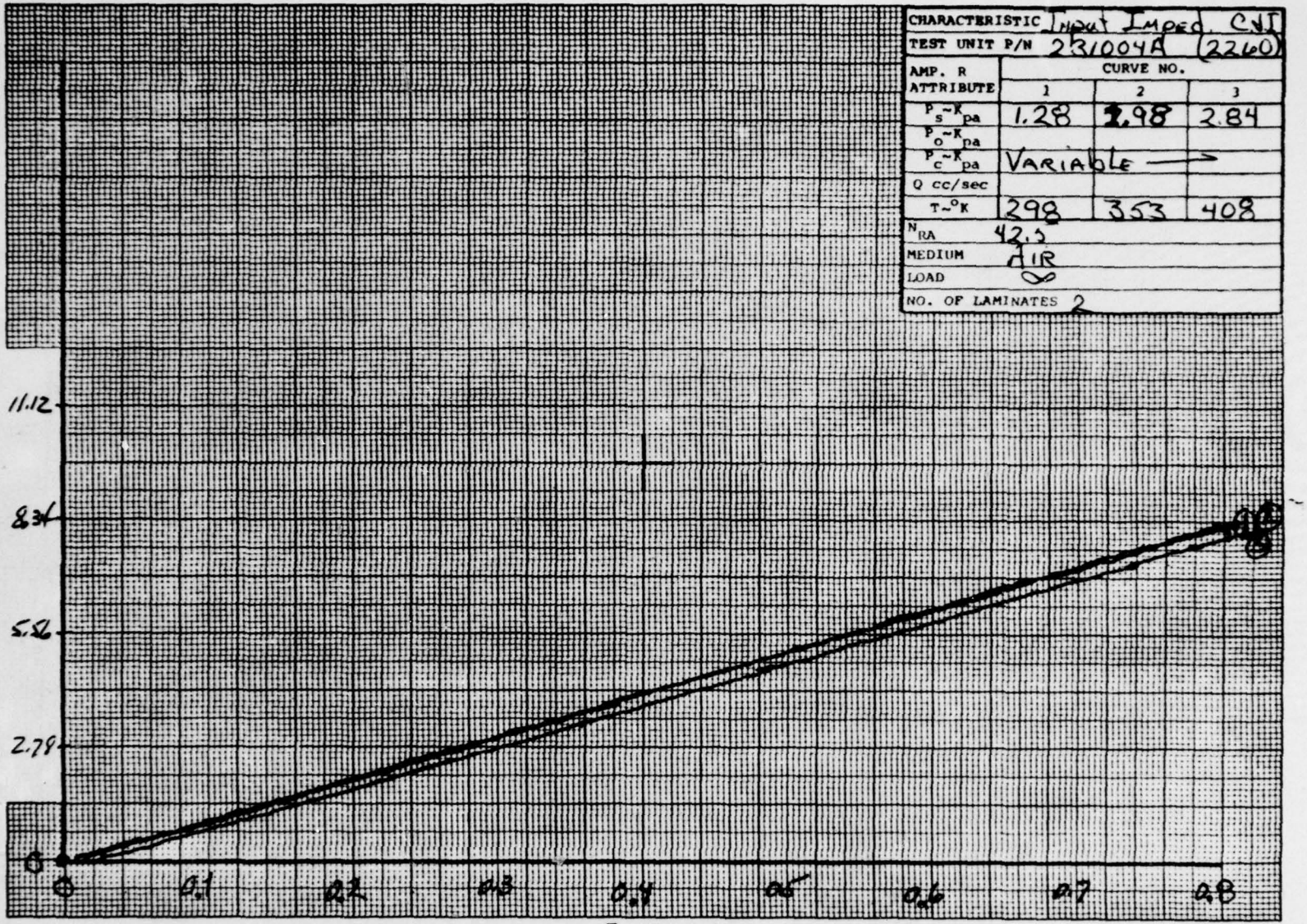

CHARACTERISTIC Input Imp C.N.I.
TEST UNIT P/N 231004A (2240)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
5.15
7.95
11.3
$P_o$~K pa
$P_c$~K pa
VARIABLE →
Q cc/sec
T~°K
298
353
408
$N_{RA}$
85
MEDIUM
AIR
LOAD
∞
NO. OF LAMINATES 2
13.9
11.12
8.34
5.56
2.78
0
0
0.25
0.5
0.75
1.0
1.25
1.5
1.75
2.0
$Q_{ci}$, $m^3$/sec X $10^7$
$P_{ci}$, kPa

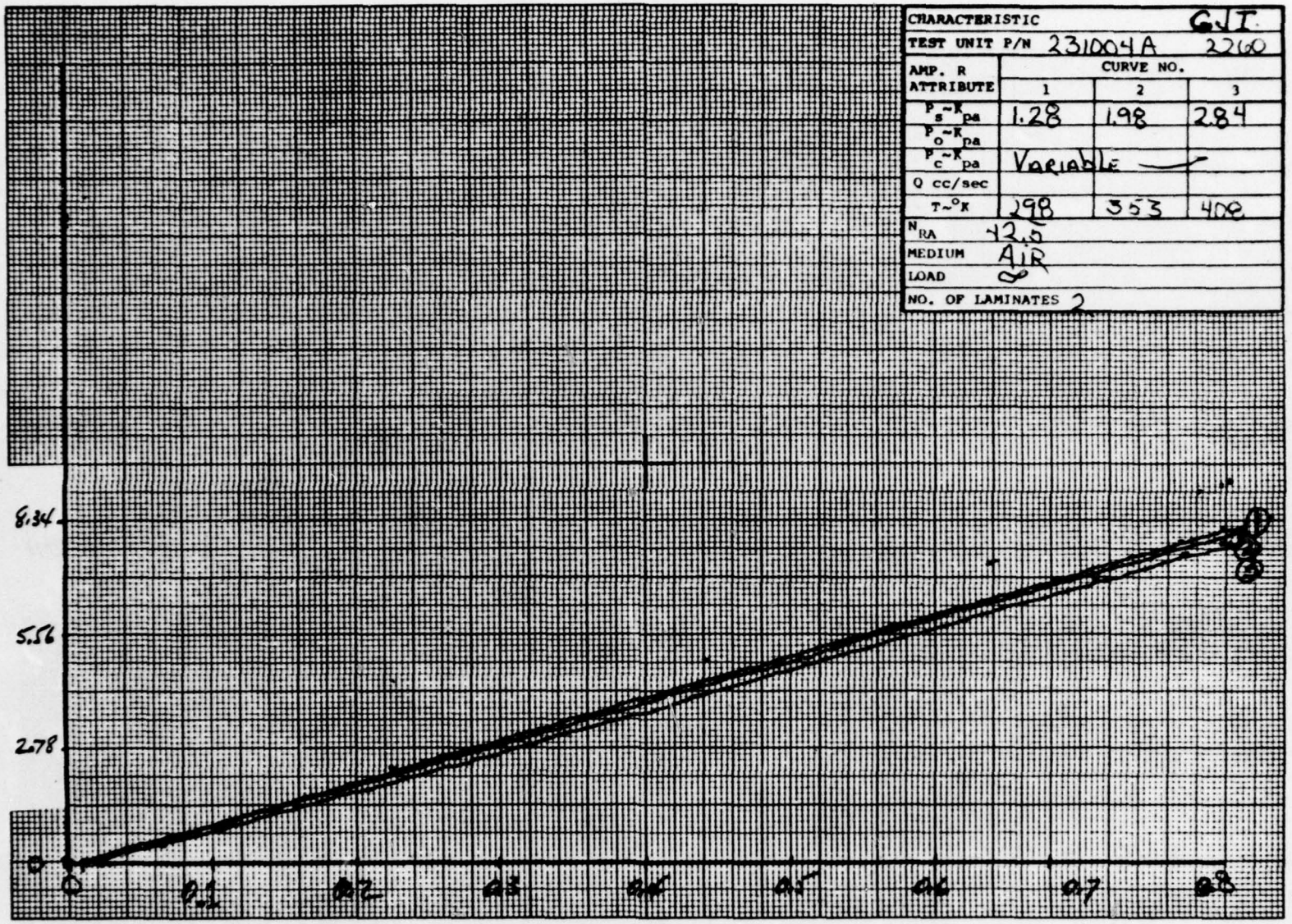
310

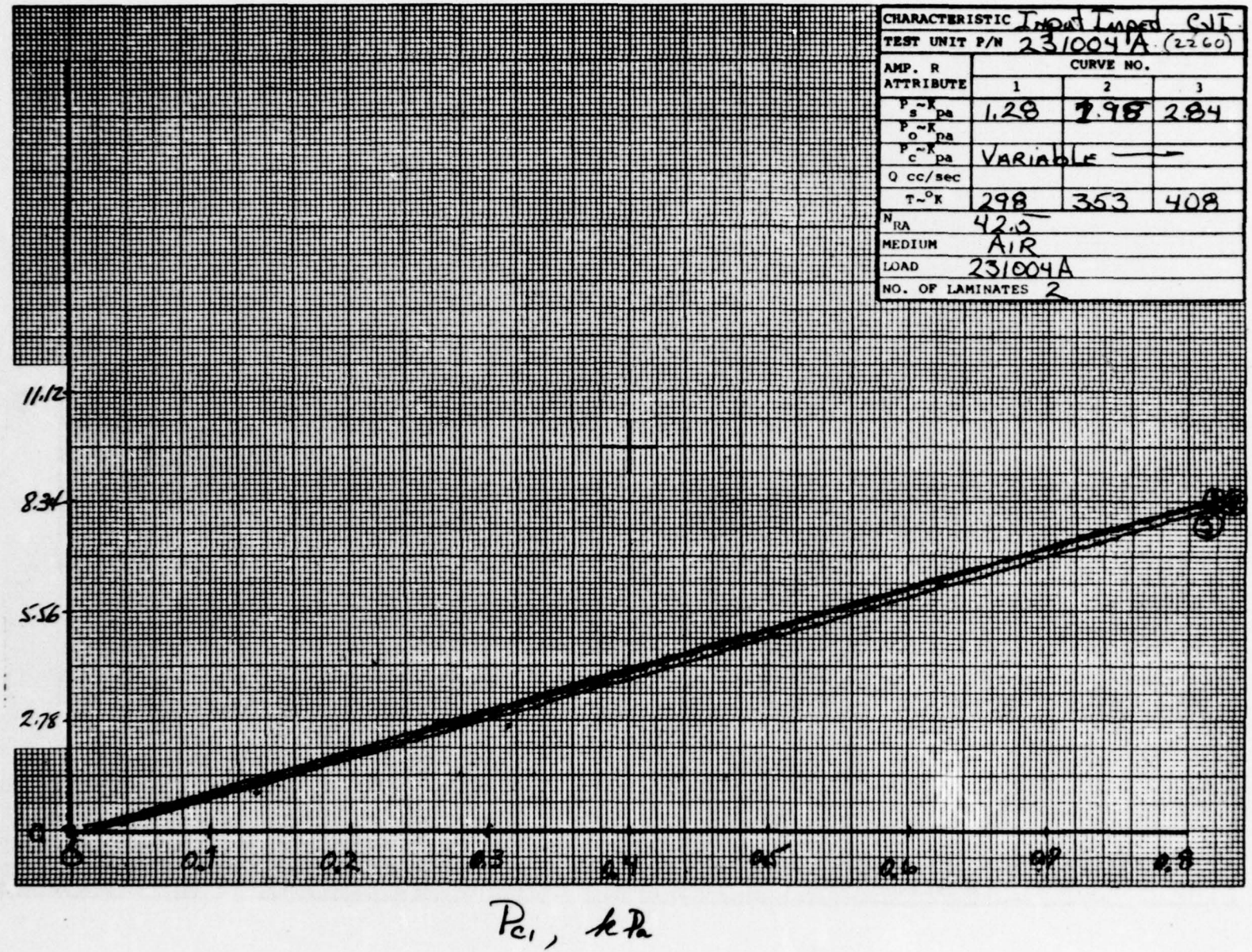

CHARACTERISTIC Input Imped. C&I
TEST UNIT P/N 231004A (2260)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
5.15
7.95
163
$P_o$~K pa
$P_c$~K pa
Varimble →
Q cc/sec
T~°K
298
353
408
$N_{RA}$
85
MEDIUM
Air
LOAD
231004A
NO. OF LAMINATES 2
13.90
11.12
8.34
5.56
2.78
0
0.25
0.5
0.75
1.0
1.25
1.5
1.75
2.0
$Q_{C1}$, $m^3$/sec X $10^7$
$P_{C1}$, kPa

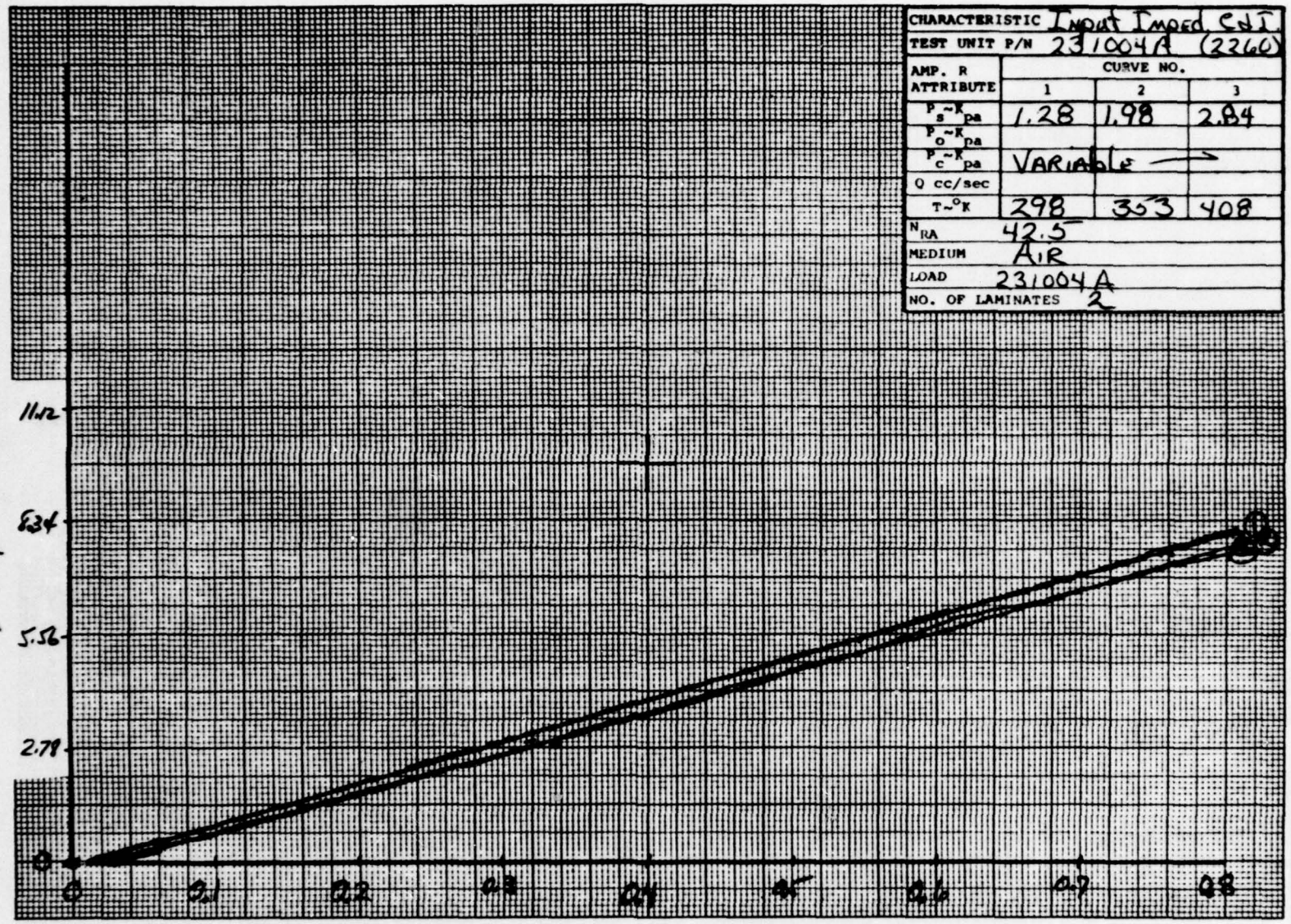

CHARACTERISTIC Input Imped. C.V.I.
TEST UNIT P/N 231004A (2260)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa 5.15 7.95 11.3
$P_o$~Kpa
$P_c$~Kpa VARIABLE →
Q cc/sec
T~°K 298 353 408
$N_{RA}$ 85
MEDIUM AIR
LOAD 231004A (2260)
NO. OF LAMINATES 2
13.90
11.12
8.34
5.56
2.78
0
0.25
0.5
.875
1.0
1.125
1.5
1.75
2.0
$Q_{cz}$, $m^3$/sec X $10^7$
$P_{cz}$, kPa

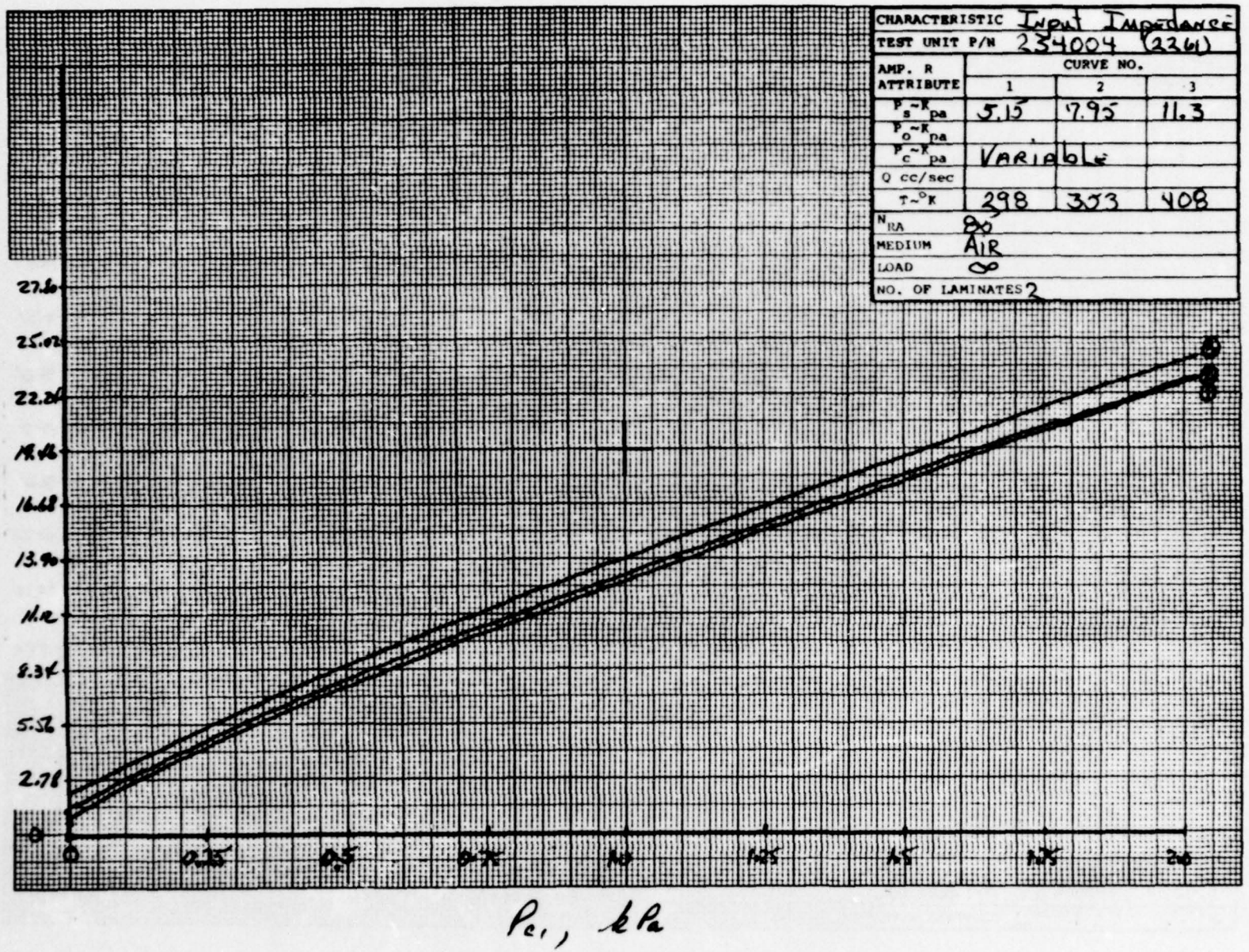
312

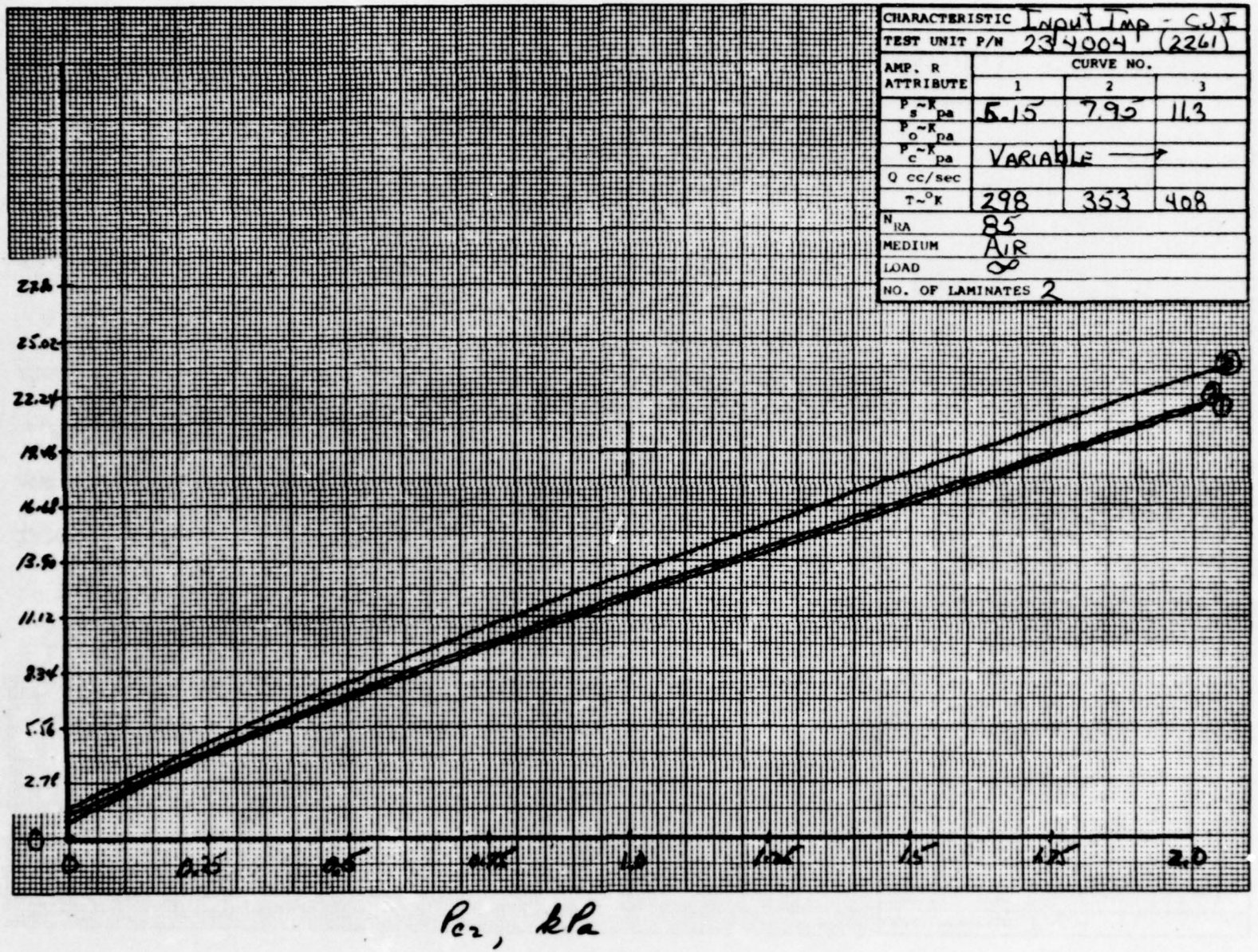

CHARACTERISTIC Input Imped. C.T.
TEST UNIT P/N 231004A (2260)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa
1.28
2.98
2.84
$P_o$~Kpa
$P_c$~Kpa
Variable →
Q cc/sec
T~°K
298
353
408
$N_{RA}$ 42.5
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
11.12
8.34
5.56
2.78
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
$Q_{C1}$, $m^3/sec \times 10^{-6}$
$P_{C1}$, kPa

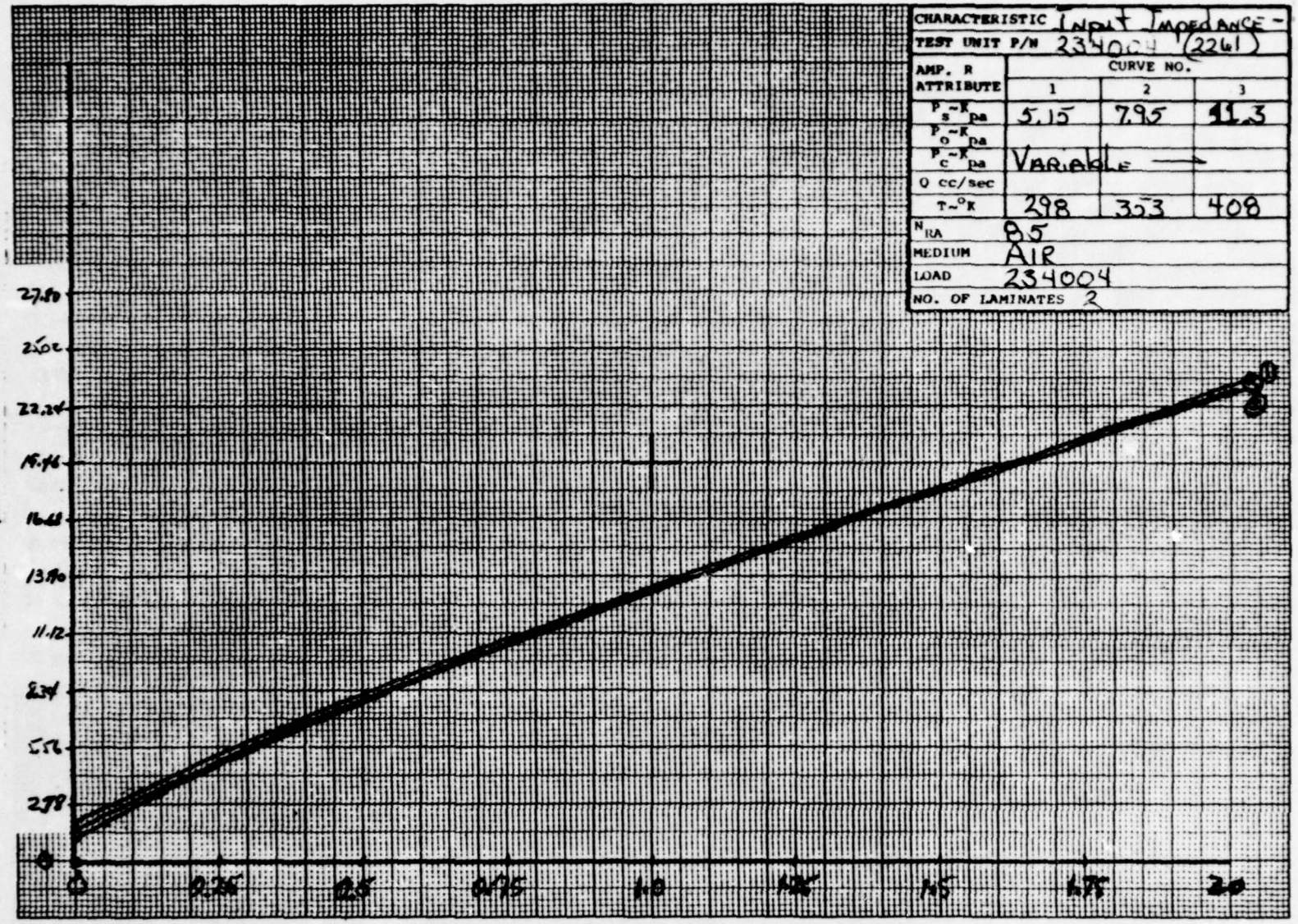

CHARACTERISTIC GJT
TEST UNIT P/N 231004A 2260
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$ ~K pa 1.28 1.98 2.84
$P_o$ ~K pa
$P_c$ ~K pa Variable
Q cc/sec
T ~°K 298 353 408
$N_{RA}$ 42.0
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
8.34
5.56
2.78
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
$Q_{c2}$, $m^3$/sec x $10^7$
$P_{c2}$, kPa

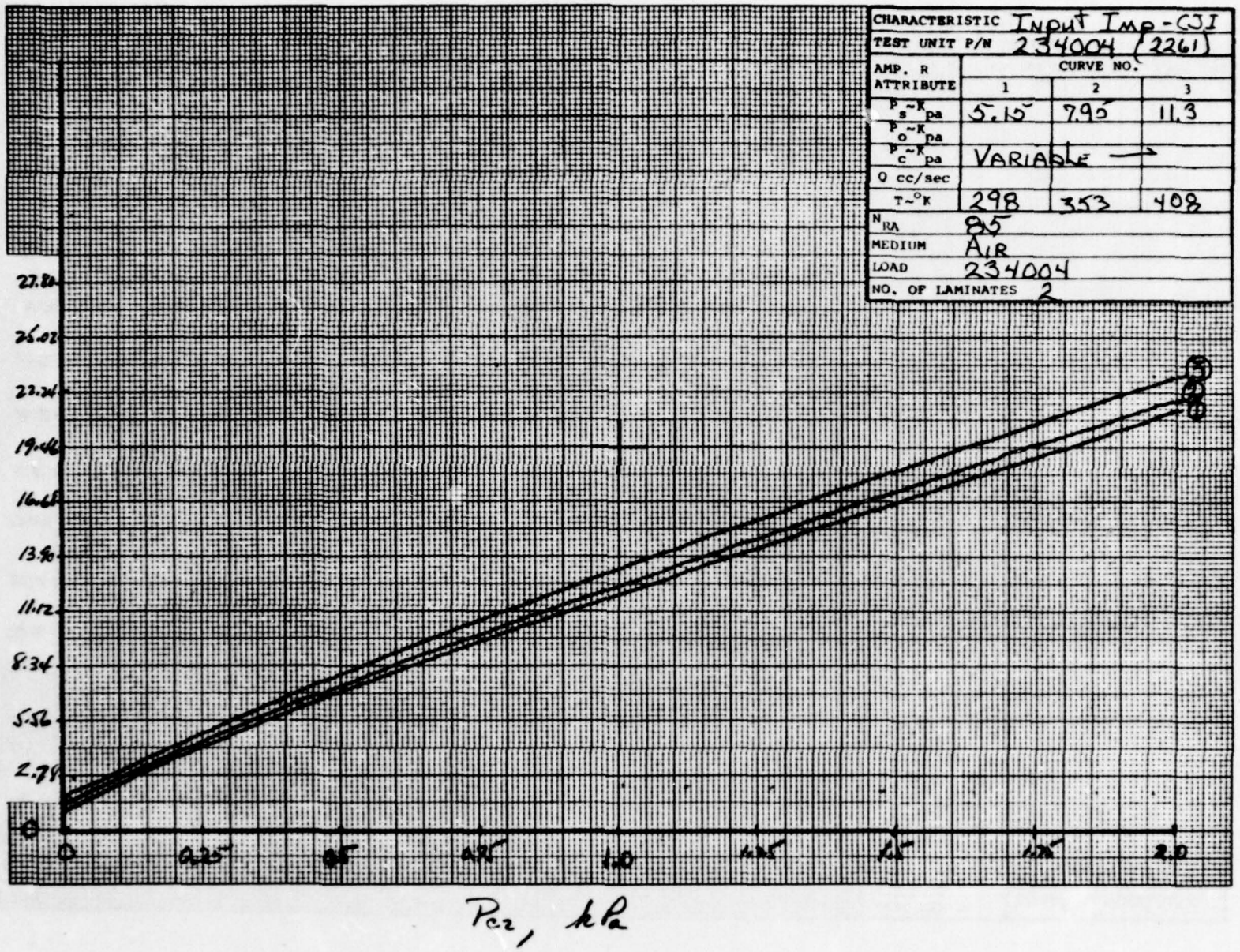

CHARACTERISTIC Input Impedance CVI
TEST UNIT P/N 231004A (2260)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
1.28
1.98
2.84
$P_o$~K pa
$P_c$~K pa
VARIABLE
Q cc/sec
T~°K
298
353
408
$N_{RA}$ 42.0
MEDIUM AIR
LOAD 231004A
NO. OF LAMINATES 2
11.12
8.34
5.56
2.78
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
$Q_{c1}$, $m^3$/sec x $10^7$
$P_{c1}$, kPa

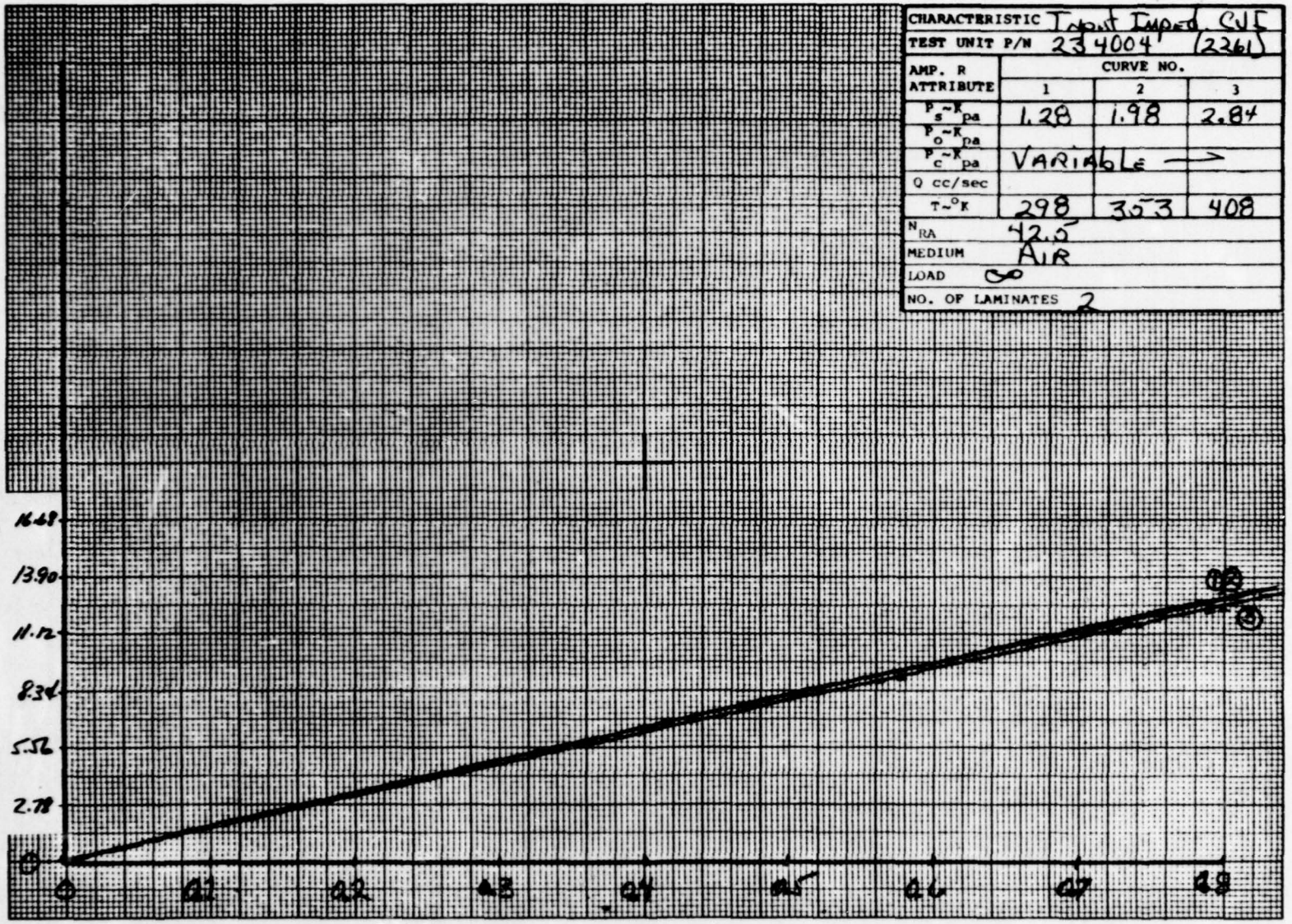

CHARACTERISTIC Input Imped. Cnt
TEST UNIT P/N 231004A (2360)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
1.28
1.98
2.84
$P_o$~K pa
$P_c$~K pa
VARIABLE →
Q cc/sec
T~°K
298
353
408
$N_{RA}$ 42.5
MEDIUM AIR
LOAD 231004A
NO. OF LAMINATES 2
$Q_{c_2}$, $m^3$/sec X $10^7$
11.12
8.34
5.56
2.78
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
$P_{c_2}$, kPa

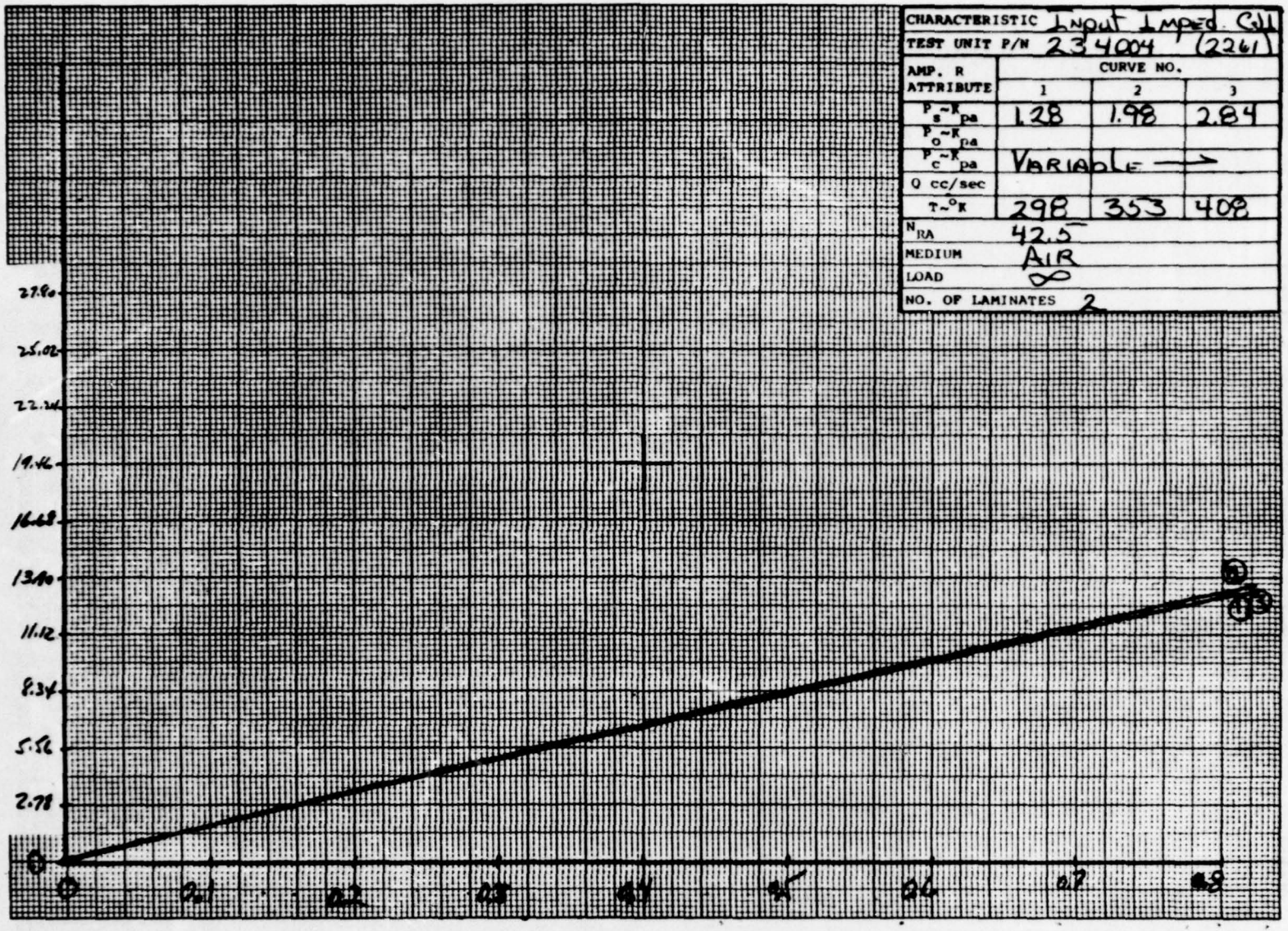

CHARACTERISTIC Input Impedance
TEST UNIT P/N 234004 (2361)
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa 5.15 7.95 11.3
$P_o$~K pa
$P_c$~K pa VARIABLE
Q cc/sec
T~°K 298 303 408
$N_{RA}$ ∞
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
27.86
25.07
22.28
19.48
16.68
13.90
11.12
8.34
5.56
2.78
0
0.25
0.5
0.75
1.0
1.25
1.5
1.75
2.0
$Q_{c_1}$, $m^3$/sec x $10^7$
$P_{c_1}$, kPa

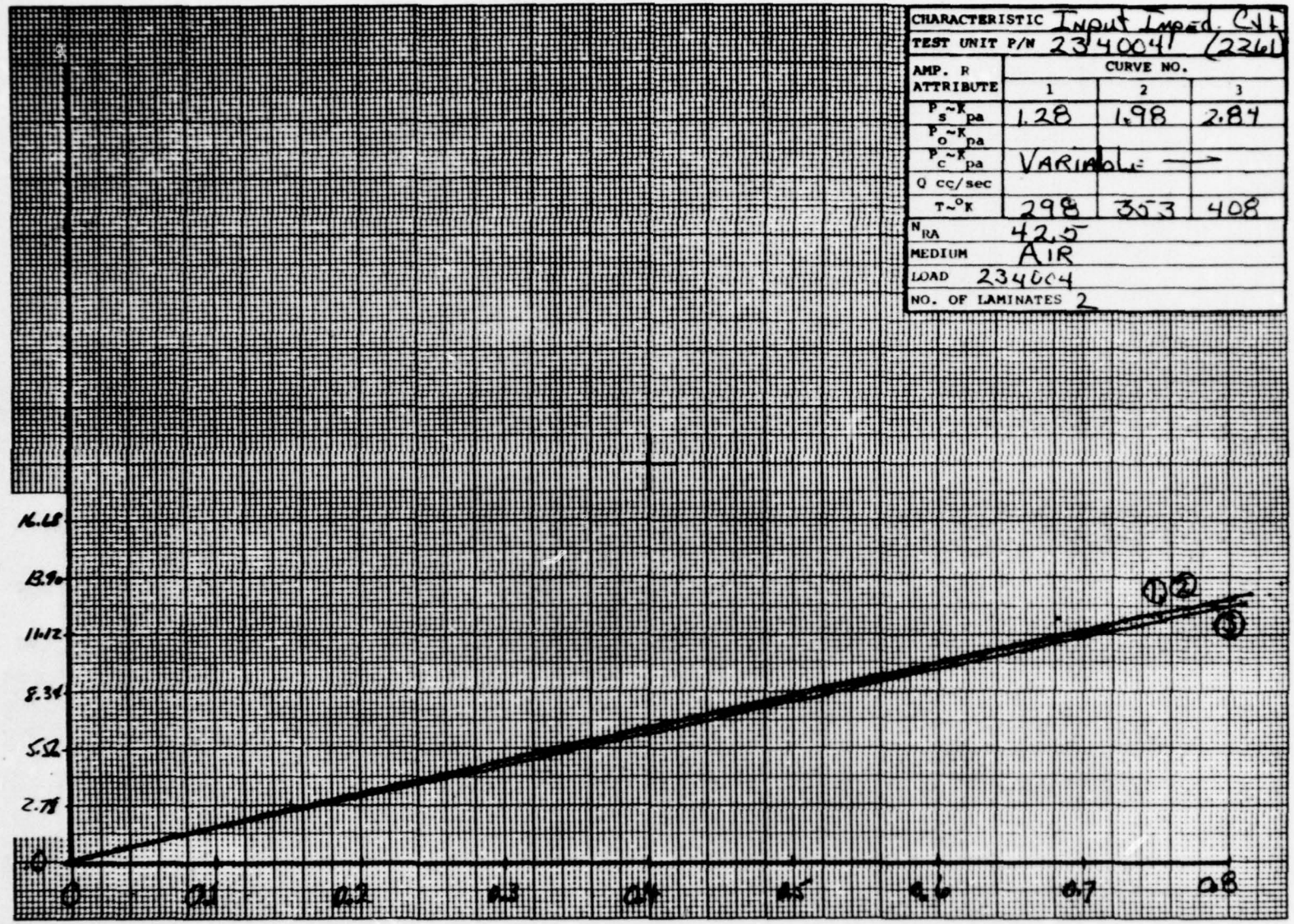

CHARACTERISTIC Input Imp - SJI
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa 5.15 7.95 11.3
$P_o$~K pa
$P_c$~K pa VARIABLE →
Q cc/sec
T~°K 298 353 408
$N_{RA}$ 85
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
$Q_{c_2}$, $m^3$/sec X $10^7$
23.8
25.02
22.24
19.46
16.68
13.90
11.12
8.34
5.56
2.78
0
0.25
0.5
0.75
1.0
1.25
1.5
1.75
2.0
$P_{c_2}$, kPa

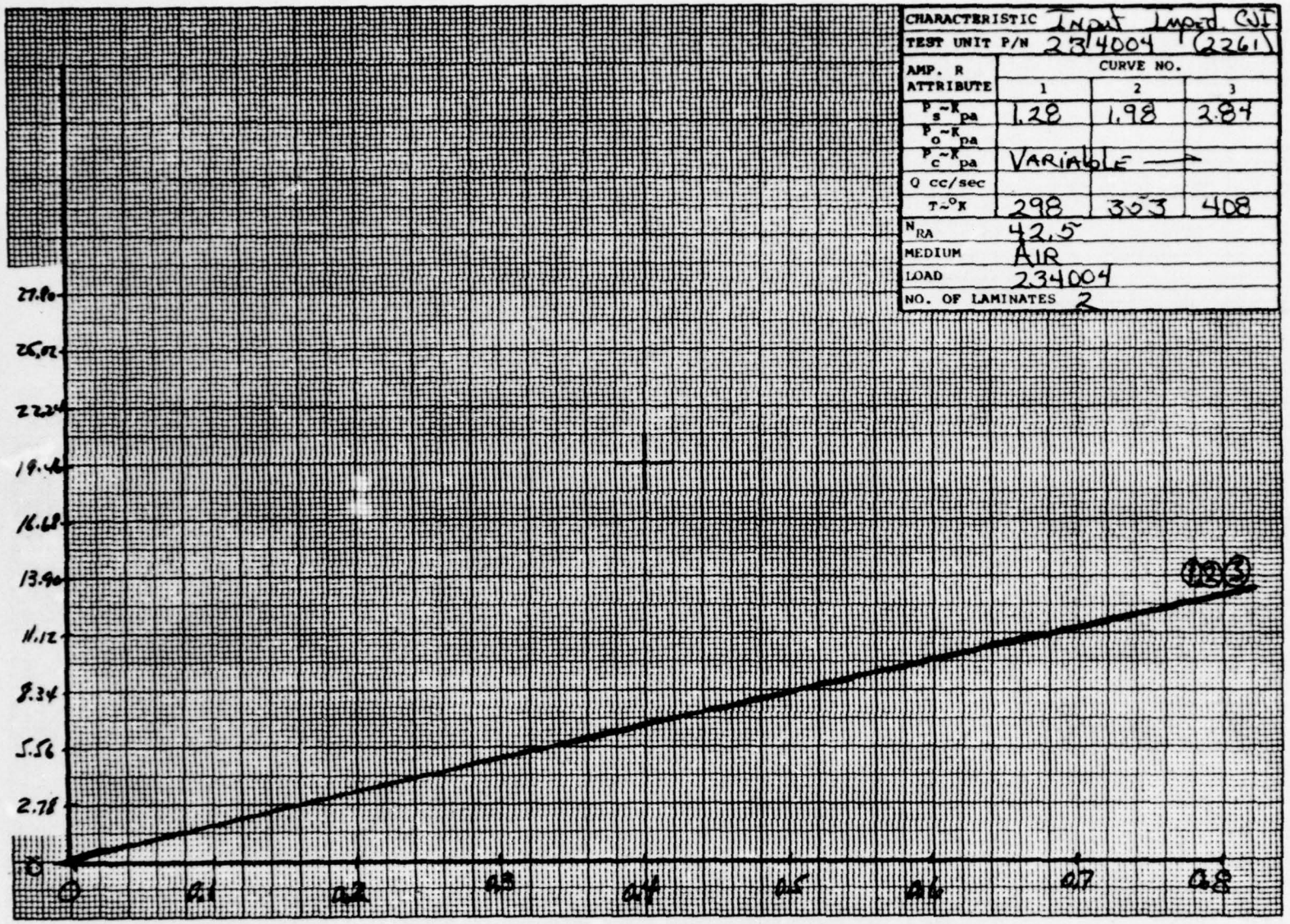

CHARACTERISTIC Input Impedance -
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~ K Pa
5.15
7.95
11.3
$P_o$ ~ K Pa
$P_c$ ~ K Pa
VARIABLE →
Q cc/sec
T ~ °K
298
323
408
$N_{RA}$ 85
MEDIUM AIR
LOAD 234004
NO. OF LAMINATES 2
27.80
25.02
22.24
19.46
16.68
13.90
11.12
8.34
5.56
2.78
0
0.25
0.5
0.75
1.0
1.25
1.5
1.75
2.0
$Q_{c_1}$, $m^3/sec \times 10^7$
$P_{c_1}$, kPa

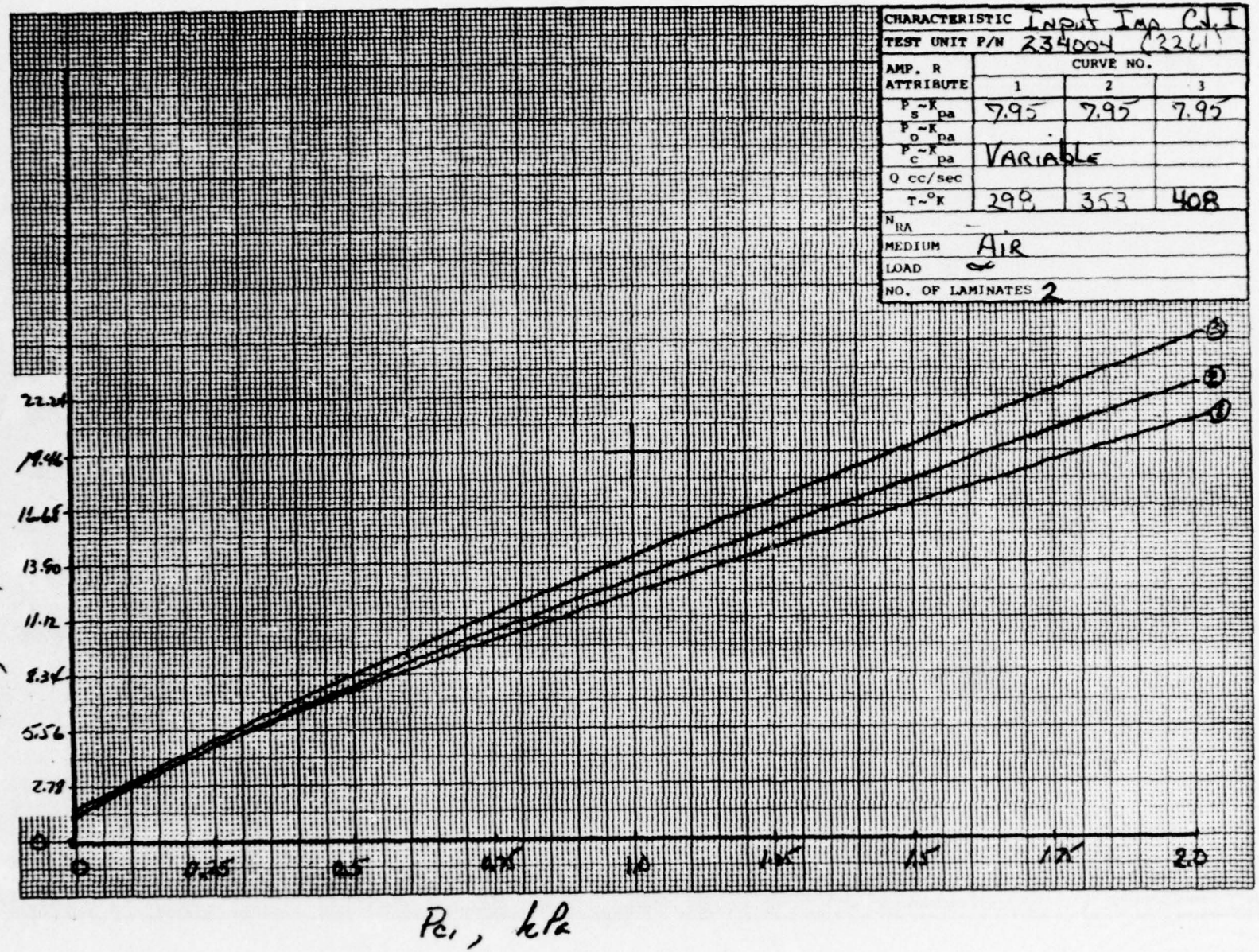

CHARACTERISTIC INPUT IMP-(J)
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa
5.15
7.95
11.3
$P_o$~Kpa
$P_c$~Kpa
VARIABLE →
Q cc/sec
T~°K
298
353
408
$N_{RA}$
95
MEDIUM
AIR
LOAD
234004
NO. OF LAMINATES
2
27.80
26.02
23.24
19.48
16.68
13.90
11.12
8.34
5.56
2.78
0
0.25
0.5
0.75
1.0
1.25
1.5
1.75
2.0
$Q_{c2}$, $m^3$/sec x $10^7$
$P_{c2}$, kPa

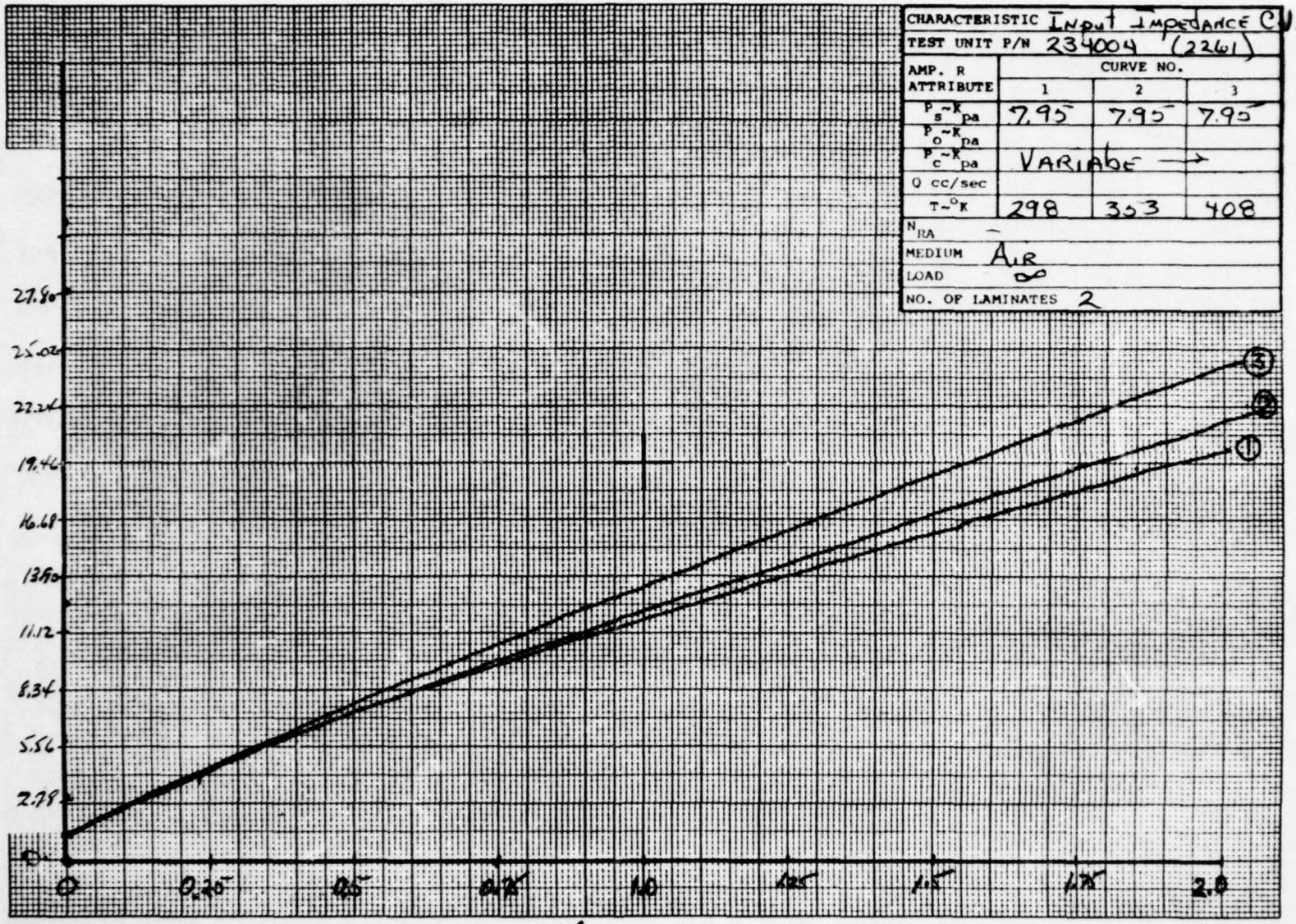

CHARACTERISTIC Input Imped. CVF
TEST UNIT P/N 234004 (2361)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
1.28
1.98
2.84
$P_o$~K pa
$P_c$~K pa
VARIABLE →
Q cc/sec
T~°K
298
353
408
$N_{RA}$
42.5
MEDIUM
AIR
LOAD
∞
NO. OF LAMINATES
2
16.68
13.90
11.12
8.34
5.56
2.78
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
$Q_{21}$, $m^3/sec \times 10^7$
$P_{e1}$; kPa

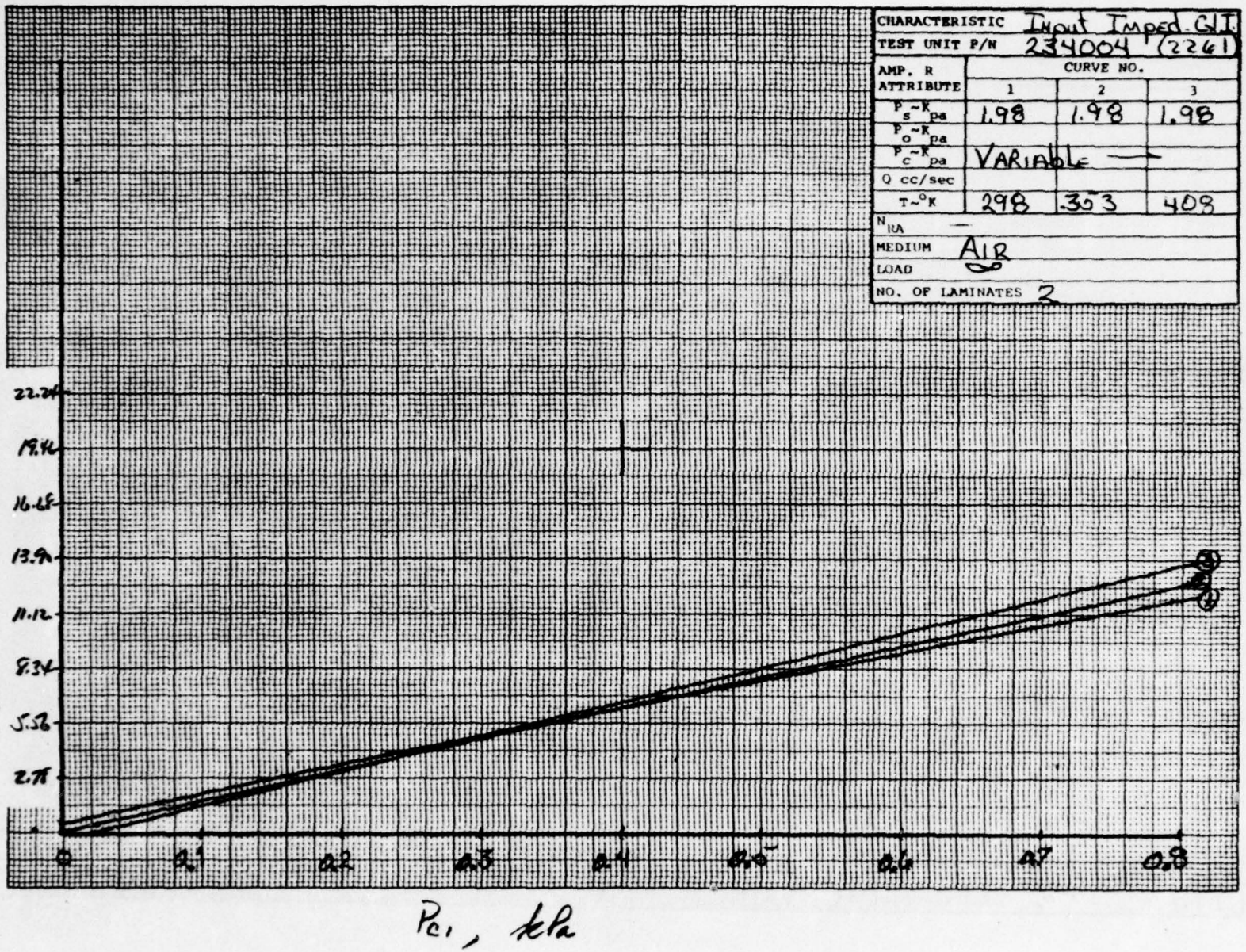

CHARACTERISTIC Input Imped. Cell
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~Kpa 1.28 1.98 2.84
$P_o$~Kpa
$P_c$~Kpa VARIABLE →
Q cc/sec
T~°K 298 353 408
$N_{RA}$ 42.5
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
27.90
25.02
22.24
19.46
16.68
13.90
11.12
8.34
5.56
2.78
$Q_{c2}$, $m^3$/sec X $10^7$
$P_{c2}$, kPa

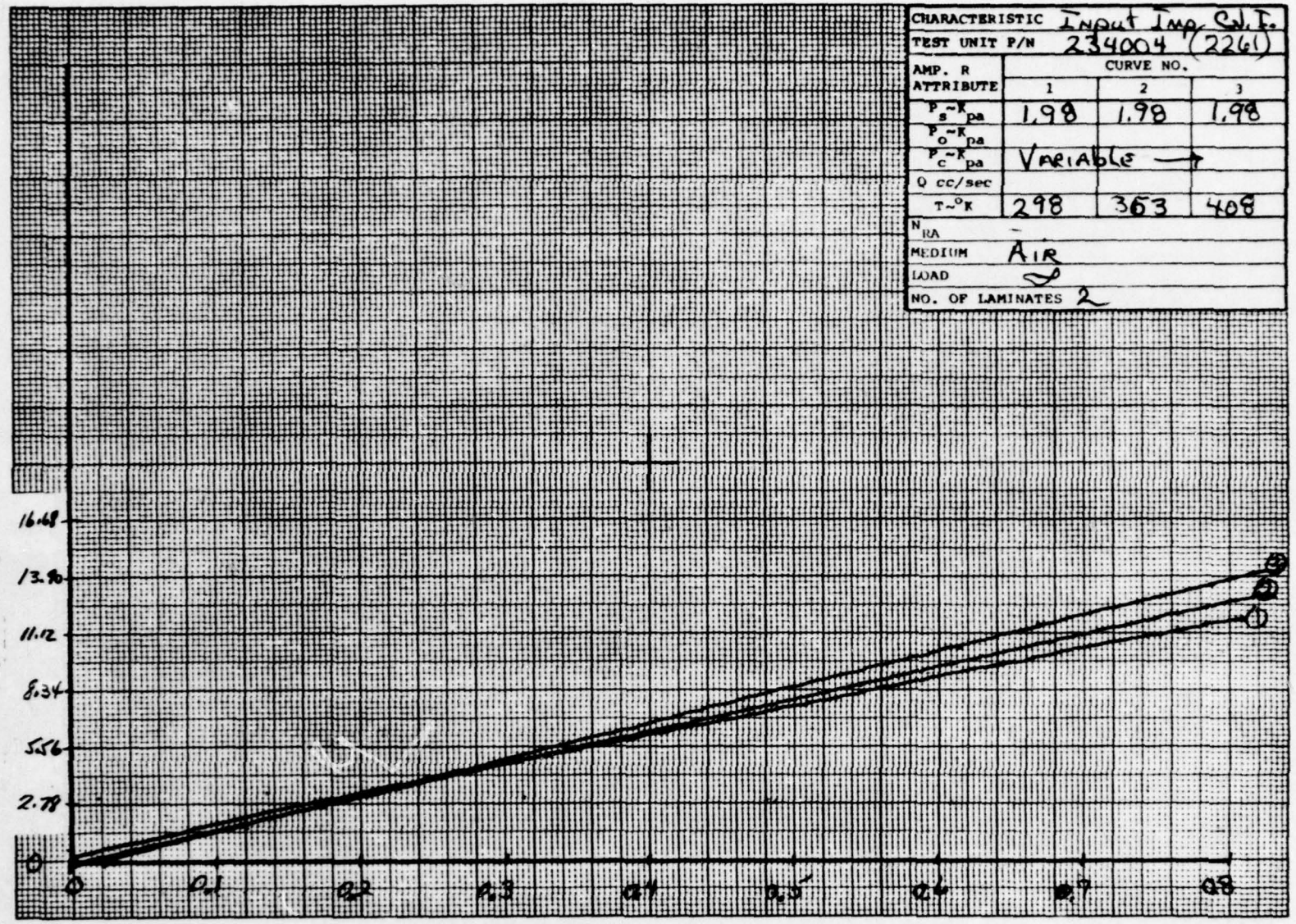

CHARACTERISTIC Input Imped. Cyl
TEST UNIT P/N 234004 (2361)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa 1.28 1.98 2.84
$P_o$~Kpa
$P_c$~Kpa VARIABLE →
Q cc/sec
T~°K 298 353 408
$N_{RA}$ 42.5
MEDIUM AIR
LOAD 234004
NO. OF LAMINATES 2
$Q_{c1}$, $m^3$/sec X $10^7$
16.68
13.90
11.12
8.34
5.52
2.78
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
$P_{c1}$, kPa

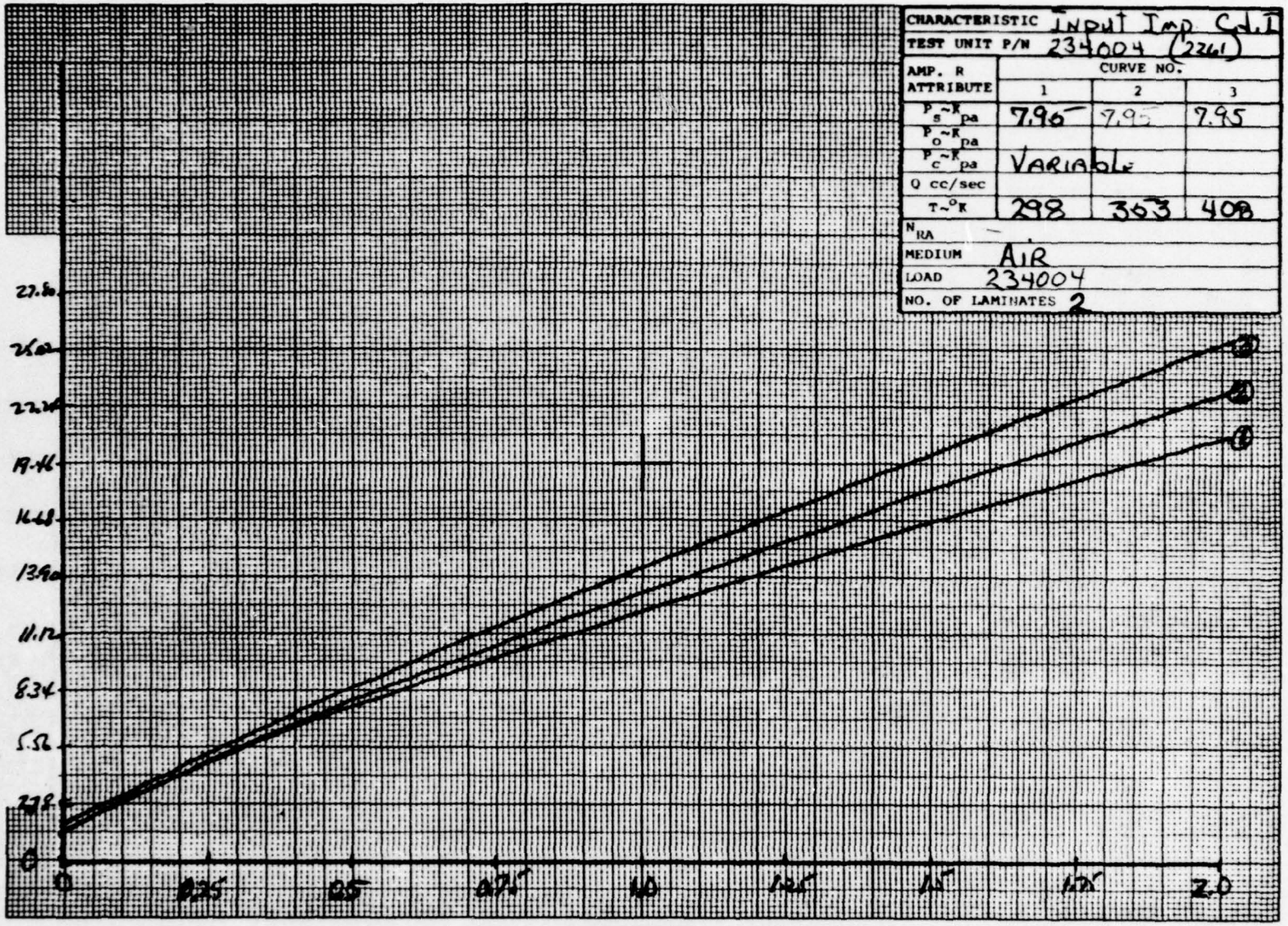

CHARACTERISTIC Input Impedance CVI
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa 1.28 1.98 2.87
$P_o$~Kpa
$P_c$~Kpa VARIABLE →
Q cc/sec
T~°K 298 303 408
$N_{RA}$ 42.5
MEDIUM AIR
LOAD 234004
NO. OF LAMINATES 2
$Q_{c2}$, $m^3$/Sec X $10^7$
27.80
25.02
22.24
19.46
16.68
13.90
11.12
8.34
5.56
2.78
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
$P_{c2}$, kPa

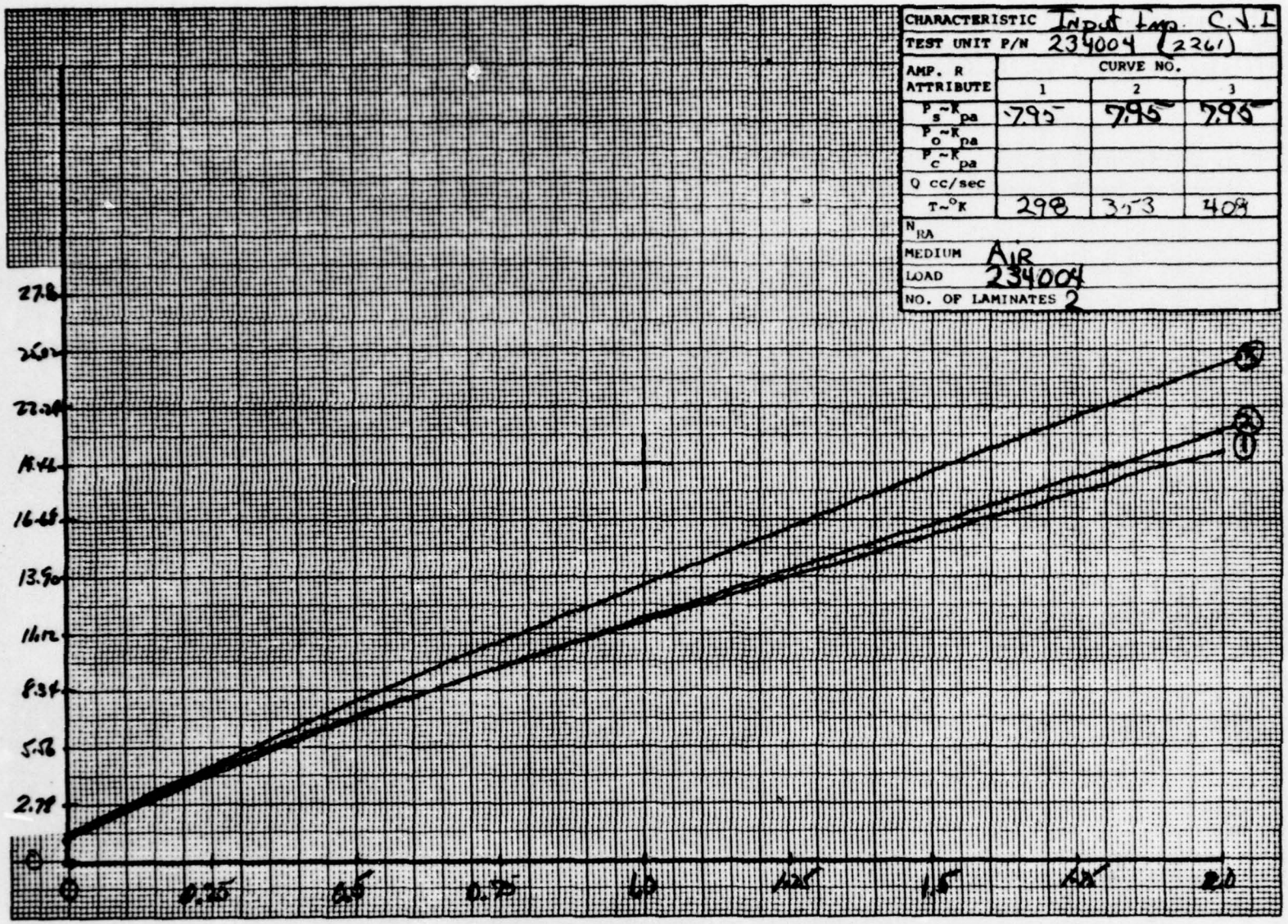

CHARACTERISTIC Input Imp Cd.I
TEST UNIT P/N 234004 (3261)
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa 7.95 7.95 7.95
$P_o$~K pa
$P_c$~K pa VARIABLE
Q cc/sec
T~°K 299 353 408
N RA
MEDIUM AIR
LOAD
NO. OF LAMINATES 2
$Q_{c1}$, $m^3$/sec X 10
22.24
19.46
16.68
13.90
11.12
8.34
5.56
2.78
0
0.25
0.5
0.75
1.0
1.25
1.5
1.75
2.0
$P_{c1}$, kPa

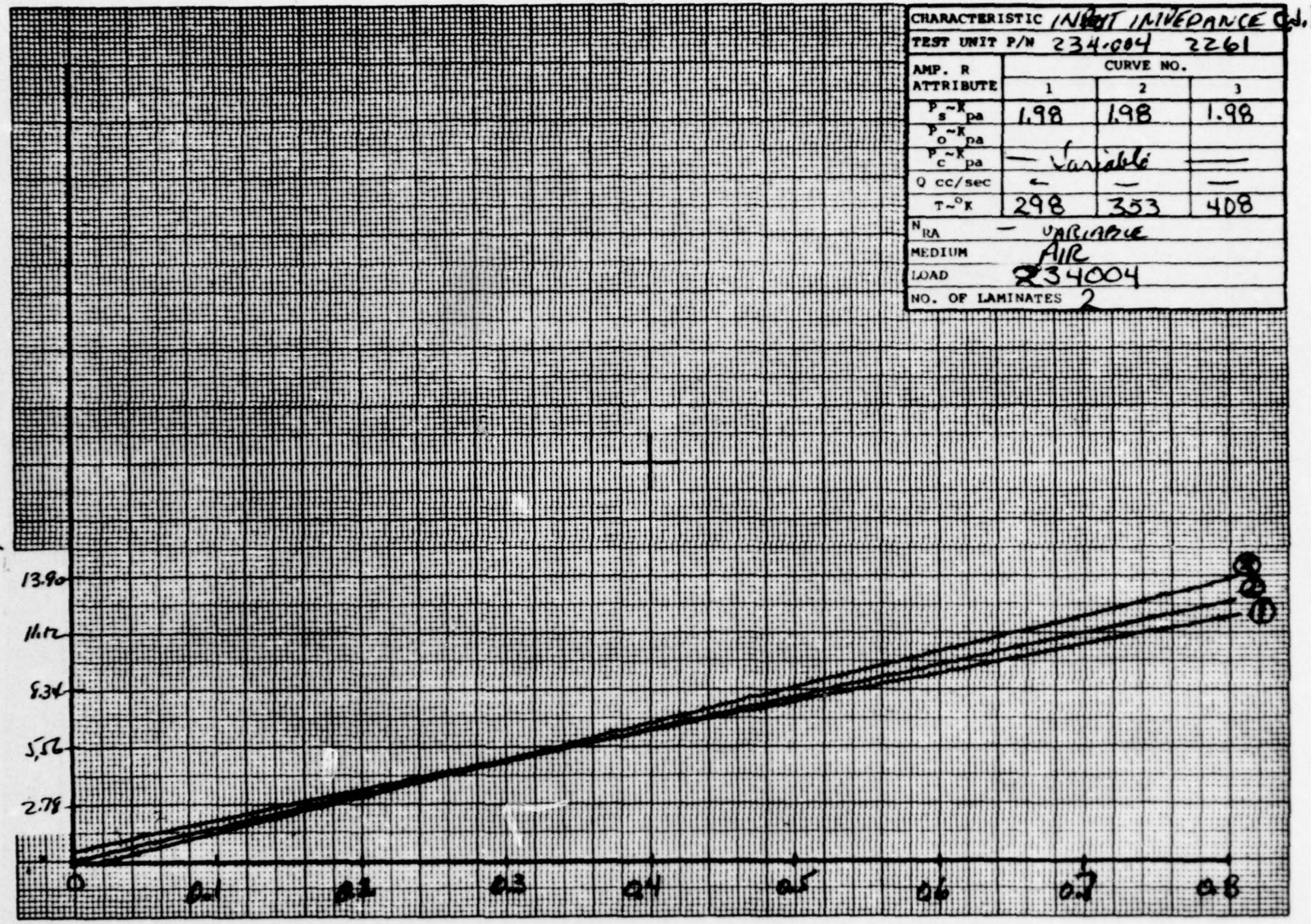

CHARACTERISTIC Input Impedance C.V.
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~Kpa 7.95 7.95 7.95
$P_o$~Kpa
$P_c$~Kpa VARIABE →
Q cc/sec
T~°K 298 303 408
$N_{IRA}$ —
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
27.80
25.02
22.24
19.46
16.68
13.90
11.12
8.34
5.56
2.78
0
0.25
0.5
0.75
1.0
1.25
1.5
1.75
2.0
$Q_{c_2}$, $m^3$/sec X $10^7$
$P_{c_2}$, kPa
1
2
3

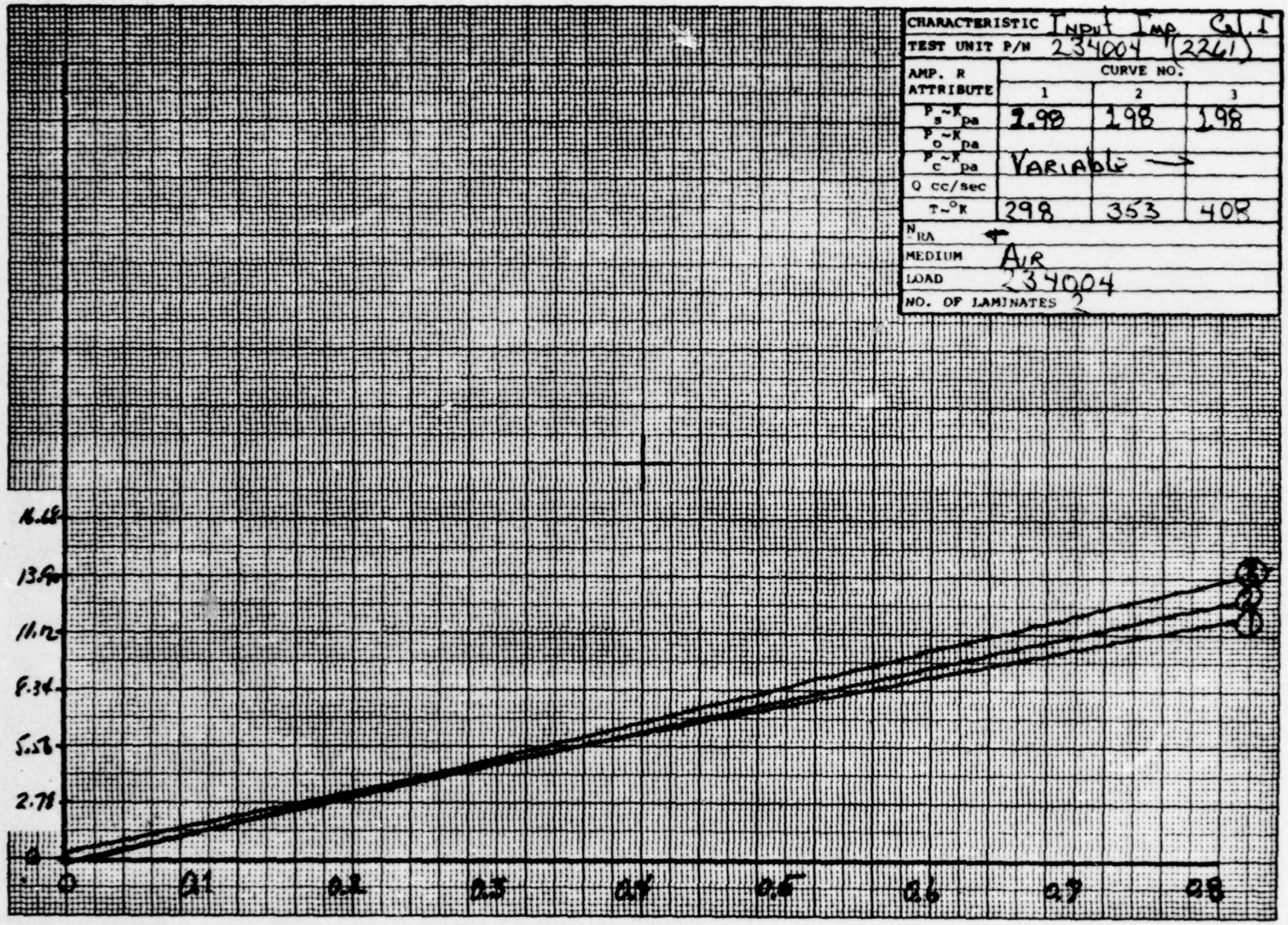

CHARACTERISTIC Inout Imped. GT
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa 1.98 1.98 1.98
$P_o$~K pa
$P_c$~K pa VARIABLE →
Q cc/sec
T~°K 298 353 408
$N_{RA}$ —
MEDIUM AIR
LOAD
NO. OF LAMINATES 2
$Q_{c_1}$, $m^3$/sec X $10^7$
22.24
19.46
16.68
13.9
11.12
8.34
5.56
2.78
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
$P_{c_1}$, kPa

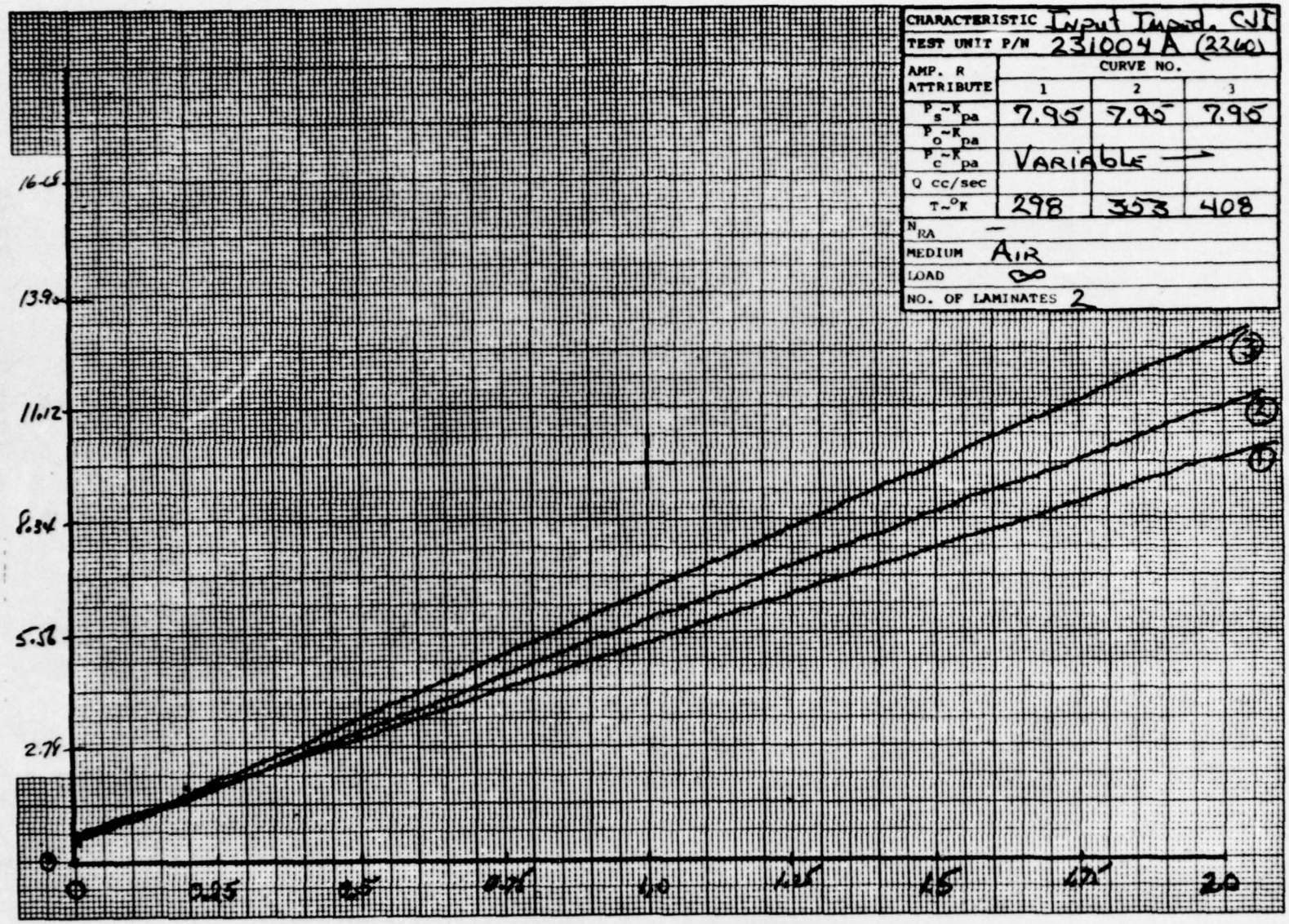

CHARACTERISTIC Input Imp. Sw. T.
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa 1.98 1.98 1.98
$P_o$~K pa
$P_c$~K pa Variable →
Q cc/sec
T~°K 298 363 408
N RA
MEDIUM AIR
LOAD
NO. OF LAMINATES 2
$P_{c2}$, $m^3/sec \times 10^7$
16.68
13.90
11.12
8.34
5.56
2.78
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
$P_{c2}$, kPa

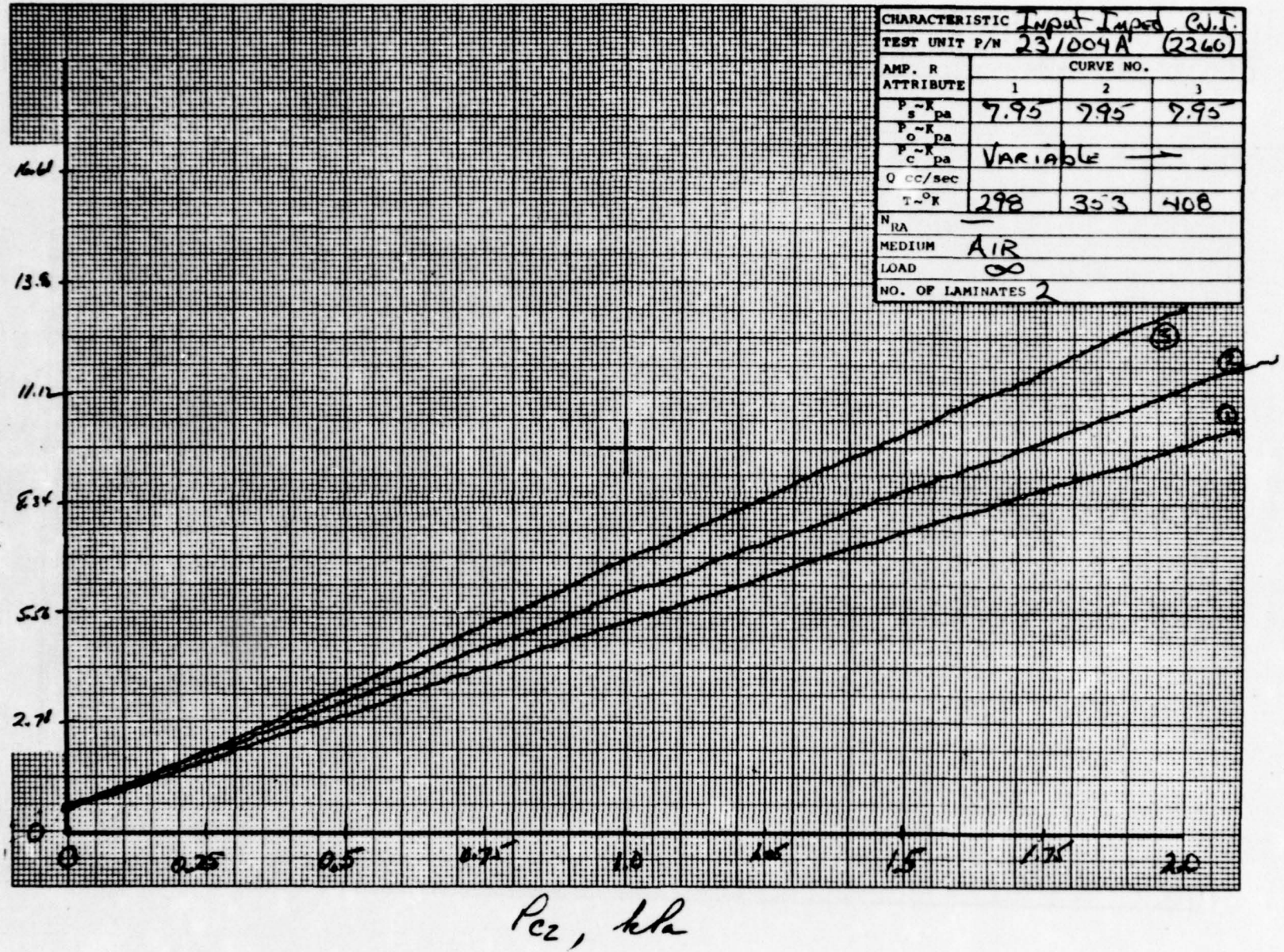

CHARACTERISTIC INPUT IMP Cal
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa 7.96 7.95 7.95
$P_o$~K pa
$P_c$~K pa VARIABLE
Q cc/sec
T~°K 298 303 408
$N_{RA}$
MEDIUM AIR
LOAD 234004
NO. OF LAMINATES 2
$Q_{c_1}$, $m^3$/sec X $10^7$
27.80
25.02
22.24
19.46
16.68
13.90
11.12
8.34
5.56
2.78
0
0
.25
.5
.75
1.0
1.25
1.5
1.75
2.0
$P_{c_1}$, kPa

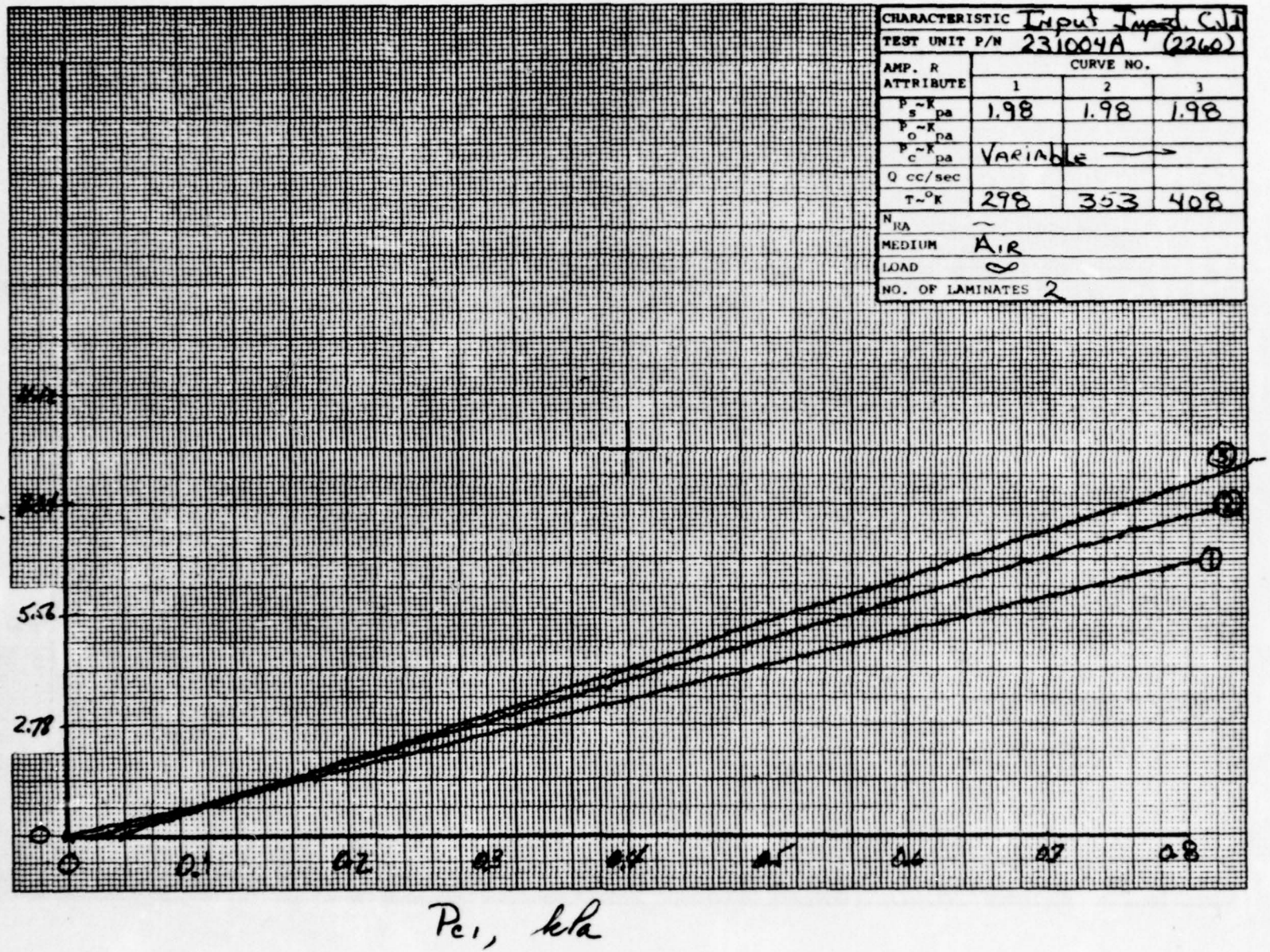

CHARACTERISTIC Input Imp. C.V.I
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa
7.95
7.95
7.95
$P_o$~Kpa
$P_c$~Kpa
Q cc/sec
T~°K
298
353
409
$N_{RA}$
MEDIUM AIR
LOAD 234004
NO. OF LAMINATES 2
$Q_{c2}$, $m^3$/sec X $10^7$
27.8
22.24
16.68
13.90
11.12
8.34
5.56
2.78
0
0.25
0.5
0.75
1.0
1.25
1.5
1.75
2.0
$P_{c2}$, kPa

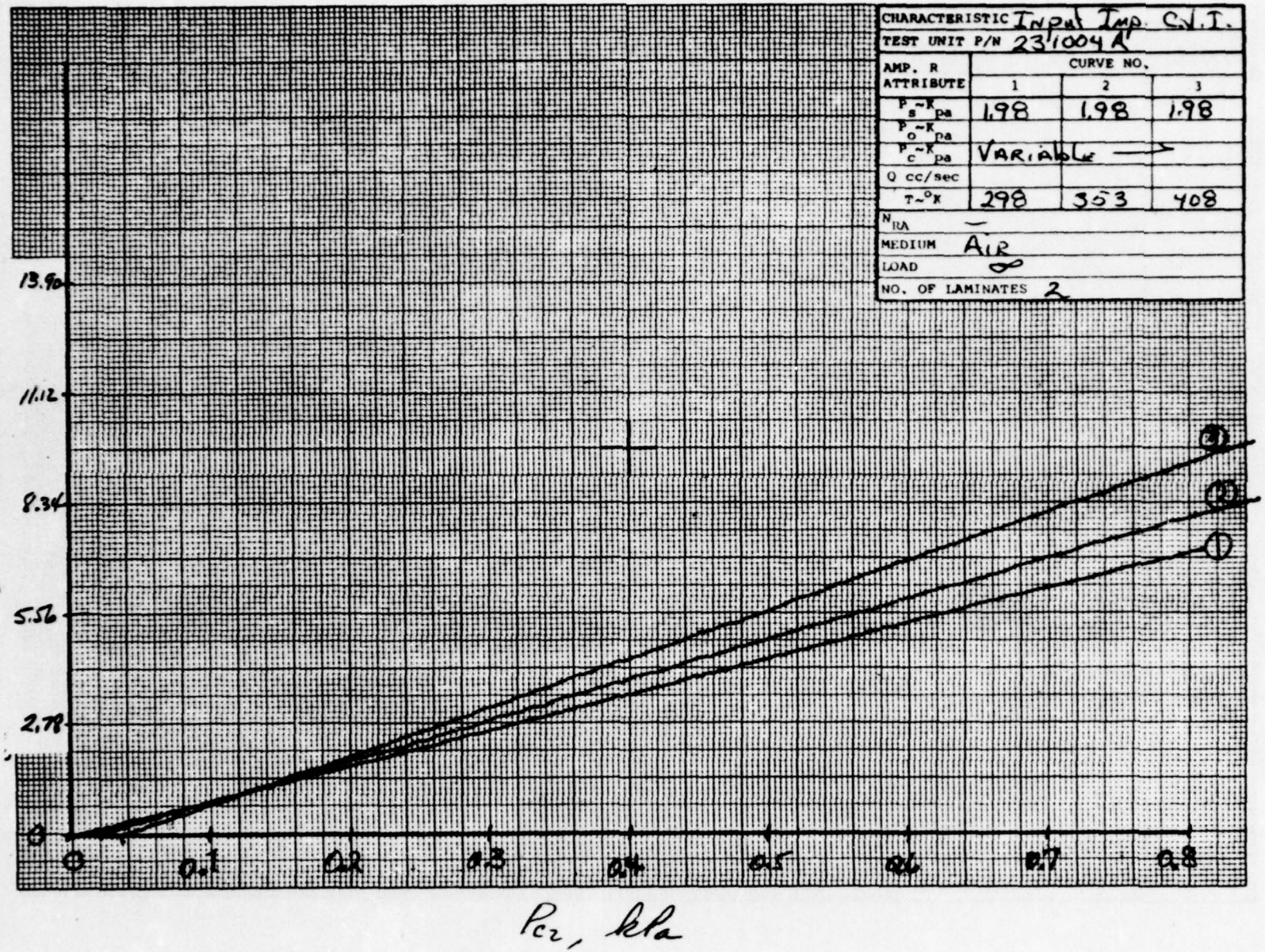

CHARACTERISTIC INLET IMPEDANCE Cd.I
TEST UNIT P/N 234-004 2261
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~K pa
1.98
1.98
1.98
$P_o$ ~K pa
$P_c$ ~K pa
— Variable —
Q cc/sec
←
—
—
T ~°K
298
353
408
$N_{RA}$ — VARIABLE
MEDIUM AIR
LOAD 234004
NO. OF LAMINATES 2
$Q_{c1}$, $m^3$/Sec X $10^7$
13.90
11.12
8.34
5.56
2.78
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
$P_{c1}$, kPa

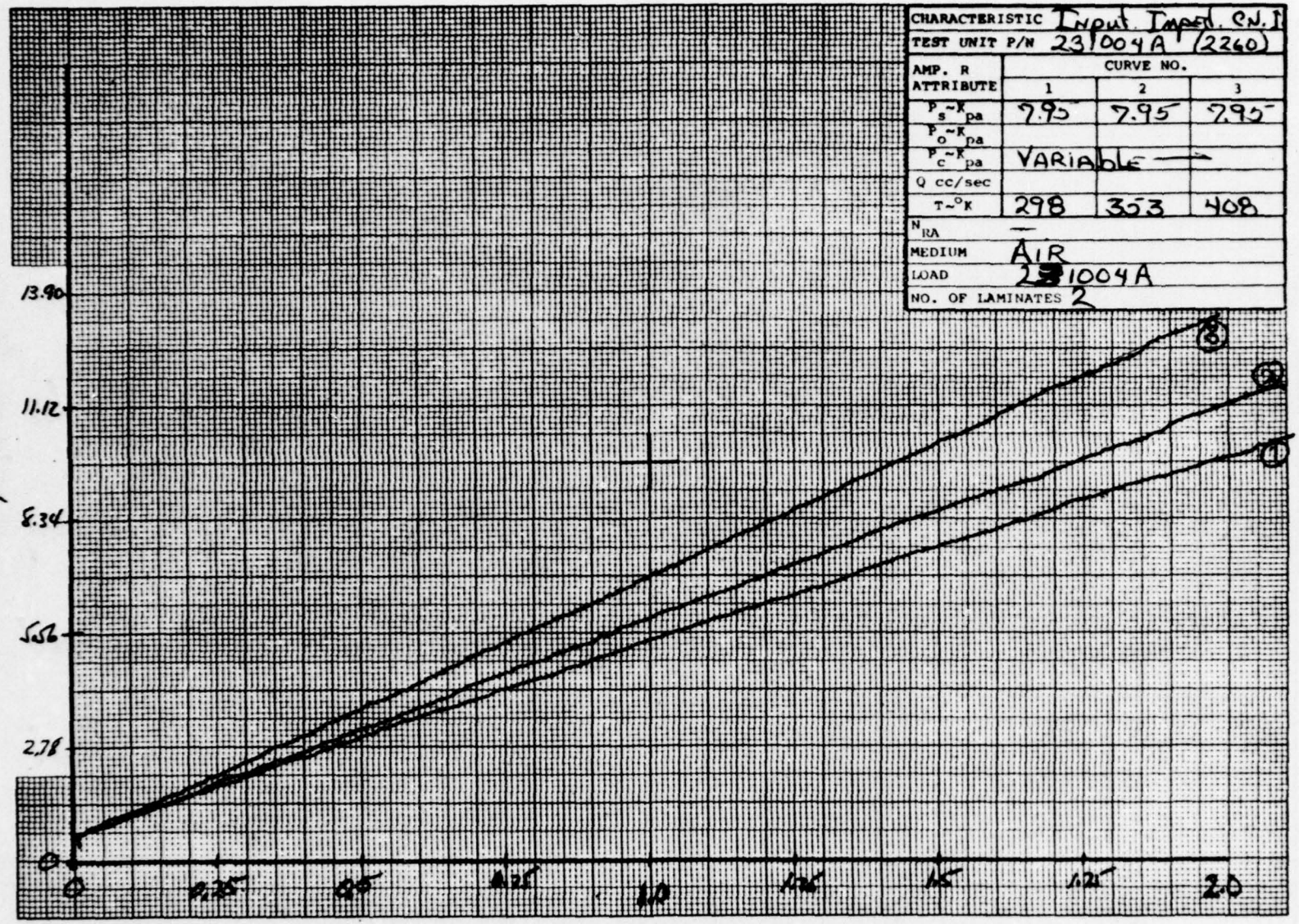

CHARACTERISTIC INPUT IMP. Col. 1
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~K pa
2.98
198
198
$P_o$ ~K pa
$P_c$ ~K pa
VARIABLE →
Q cc/sec
T ~°K
298
353
408
$N_{RA}$
MEDIUM
AIR
LOAD
234004
NO. OF LAMINATES 2
$Q_{c_2}$, $m^3$/sec x $10^3$
16.68
13.90
11.12
8.34
5.56
2.78
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
$P_{c_2}$, kPa

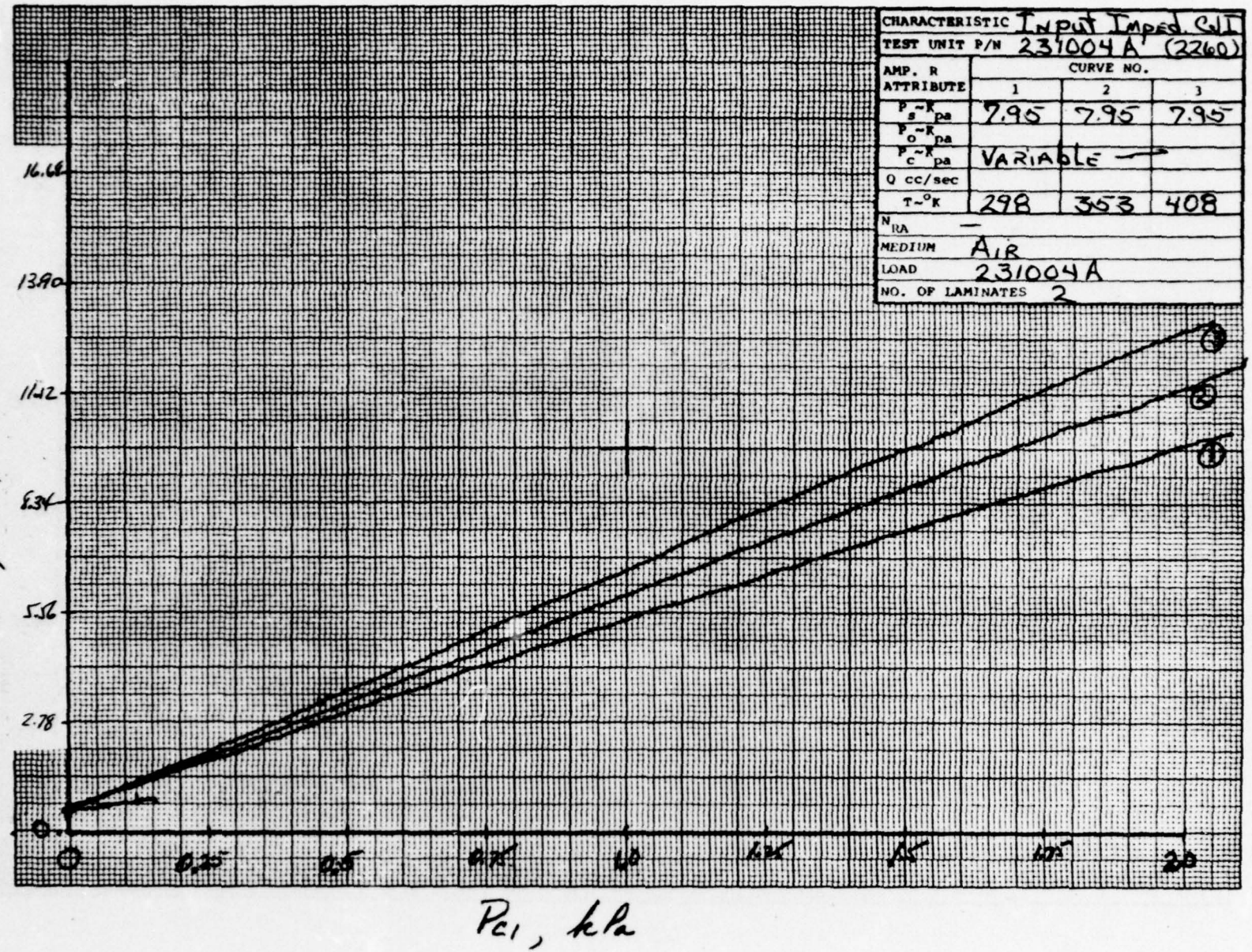

CHARACTERISTIC Input Imped. CVT
TEST UNIT P/N 231004 A (2360)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~ Kpa
7.95
7.95
7.95
$P_o$ ~ Kpa
$P_c$ ~ Kpa
VARIABLE →
Q cc/sec
T ~ °K
298
353
408
$N_{RA}$ —
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
16.68
13.9
11.12
8.34
5.56
2.78
0
0.25
0.5
0.75
1.0
1.25
1.5
1.75
2.0
$Q_{c_1}$, $m^3/sec \times 10^7$
$P_{c_1}$, kPa

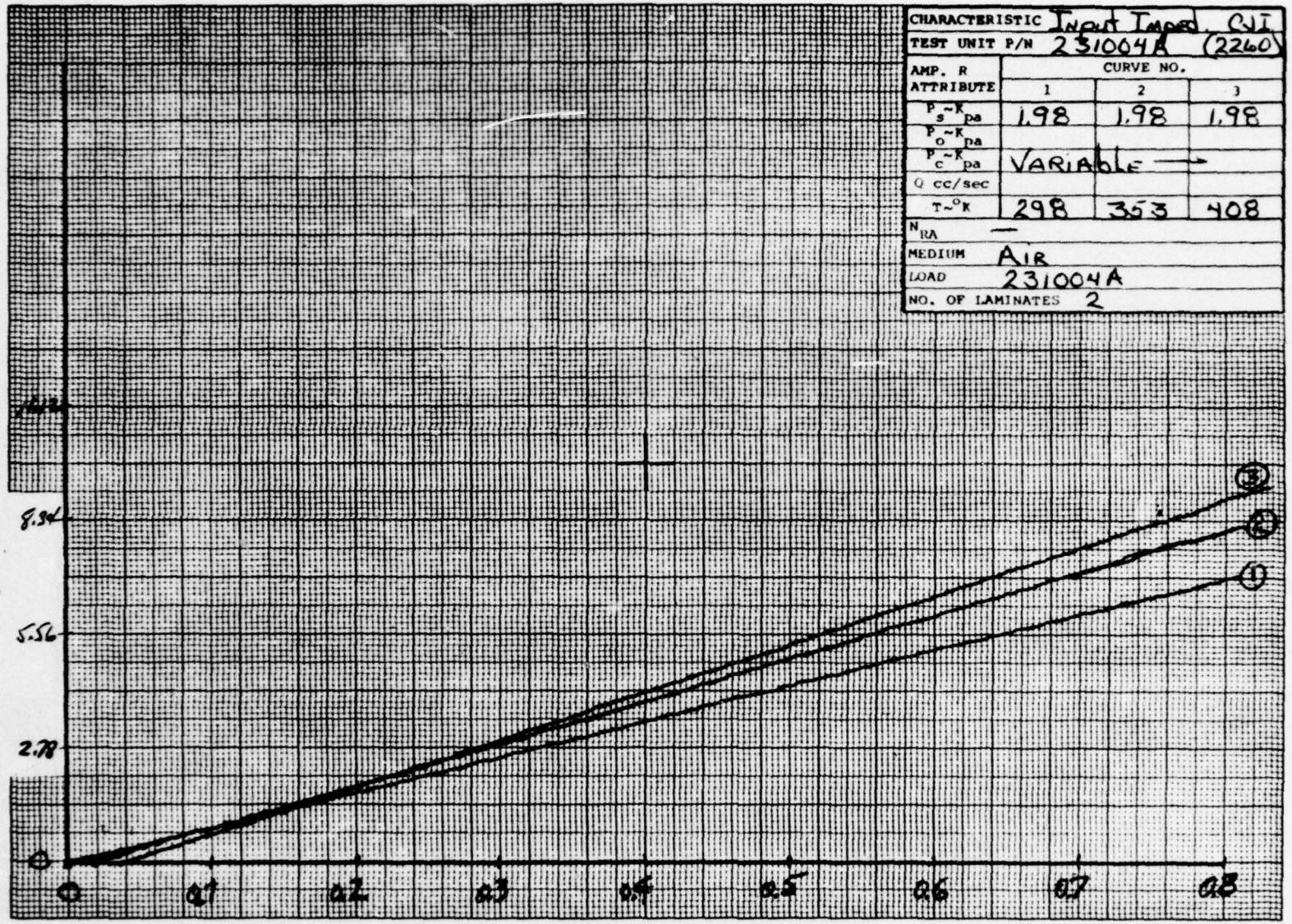

CHARACTERISTIC Input Imped C.W.I.
TEST UNIT P/N 231004A (2260)
AMP. R ATTRIBUTE
CURVE NO.
1 2 3
$P_s$~Kpa 7.95 7.95 7.95
$P_o$~Kpa
$P_c$~Kpa VARIABLE →
Q cc/sec
T~°K 298 353 408
$N_{RA}$ —
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
16.6
13.8
11.12
8.34
5.56
2.78
0
0
0.25
0.5
0.75
1.0
1.25
1.5
1.75
2.0
$Q_{c2}$, $m^3/sec \times 10^7$
$P_{c2}$, kPa

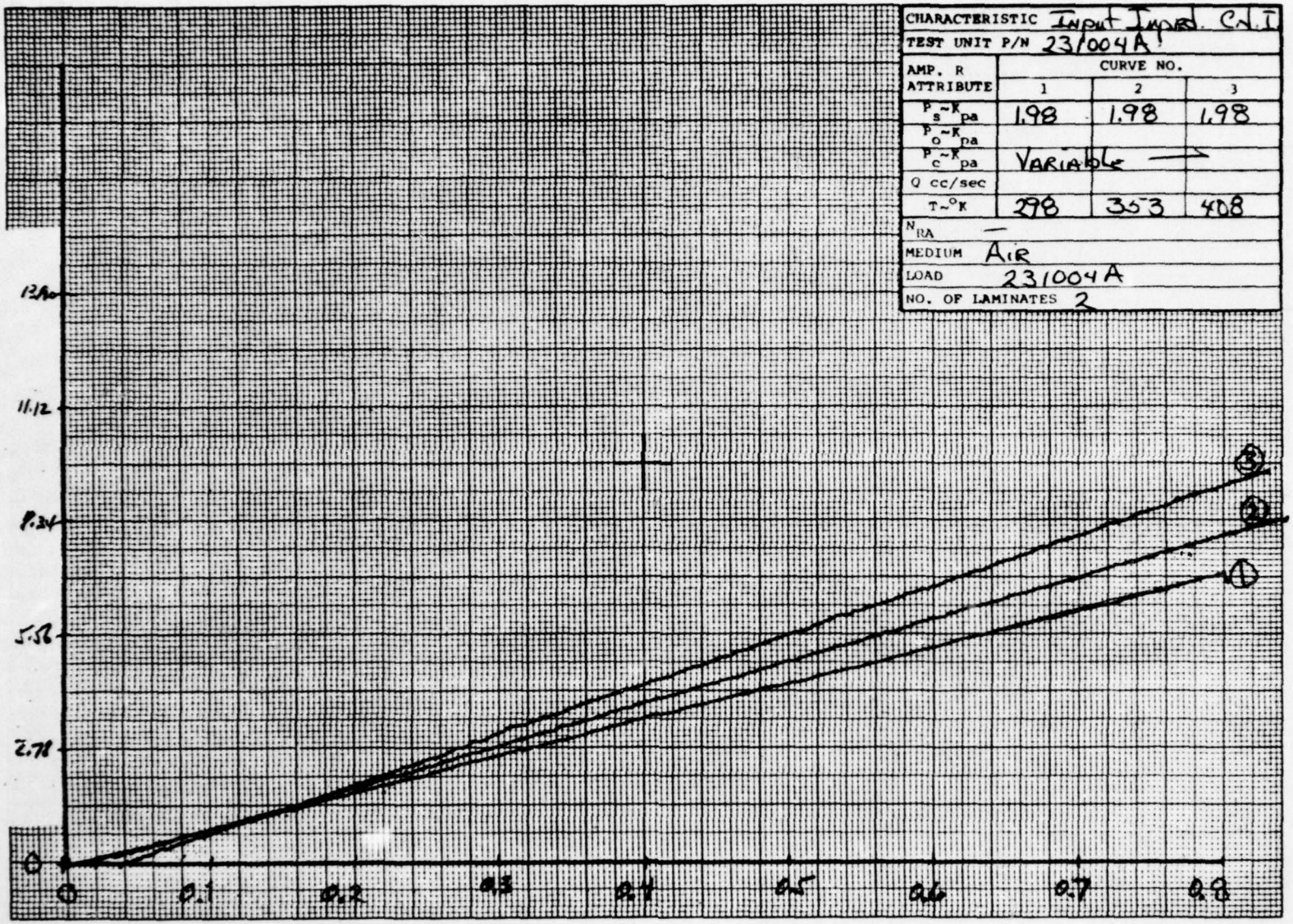

CHARACTERISTIC Input Imped. Cold
TEST UNIT P/N 231004A (2260)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
1.98
1.98
1.98
$P_o$~K pa
$P_c$~K pa
VARIABLE →
Q cc/sec
T~°K
298
353
408
$N_{RA}$ ~
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
$Q_{c1}$, $m^3$/sec X $10^7$
5.56
2.78
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
$P_{c1}$, kPa

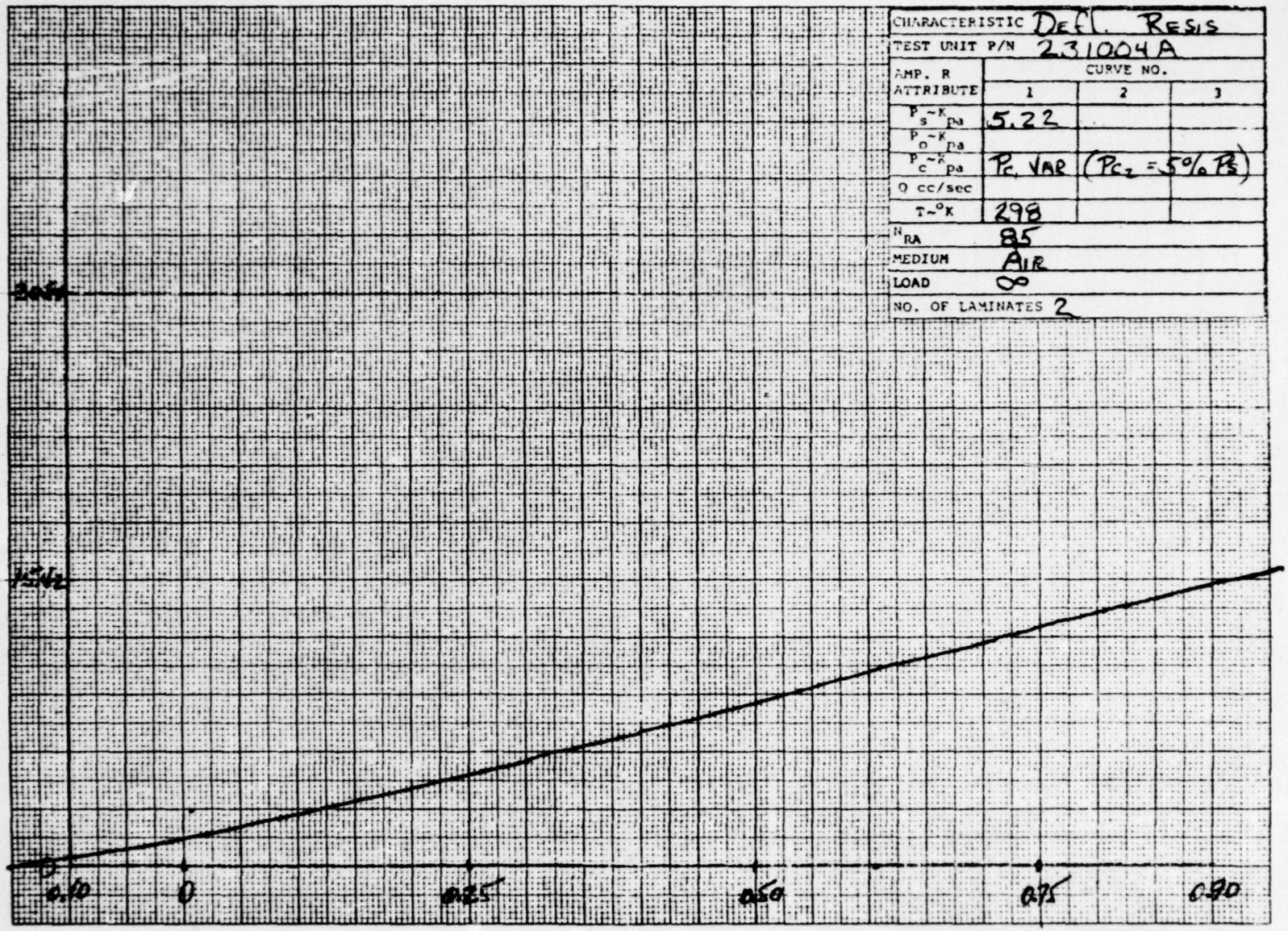

CHARACTERISTIC Input Imp. C.V.I.
TEST UNIT P/N 23'1004 A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa 1.98 1.98 1.98
$P_o$~Kpa
$P_c$~Kpa VARIABLE →
Q cc/sec
T~°K 298 353 408
$N_{RA}$ —
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
13.90
11.12
8.34
5.56
2.78
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
$Q_{c_2}$, $m^3/sec \times 10^7$
$P_{c_2}$, kPa
1
2
3

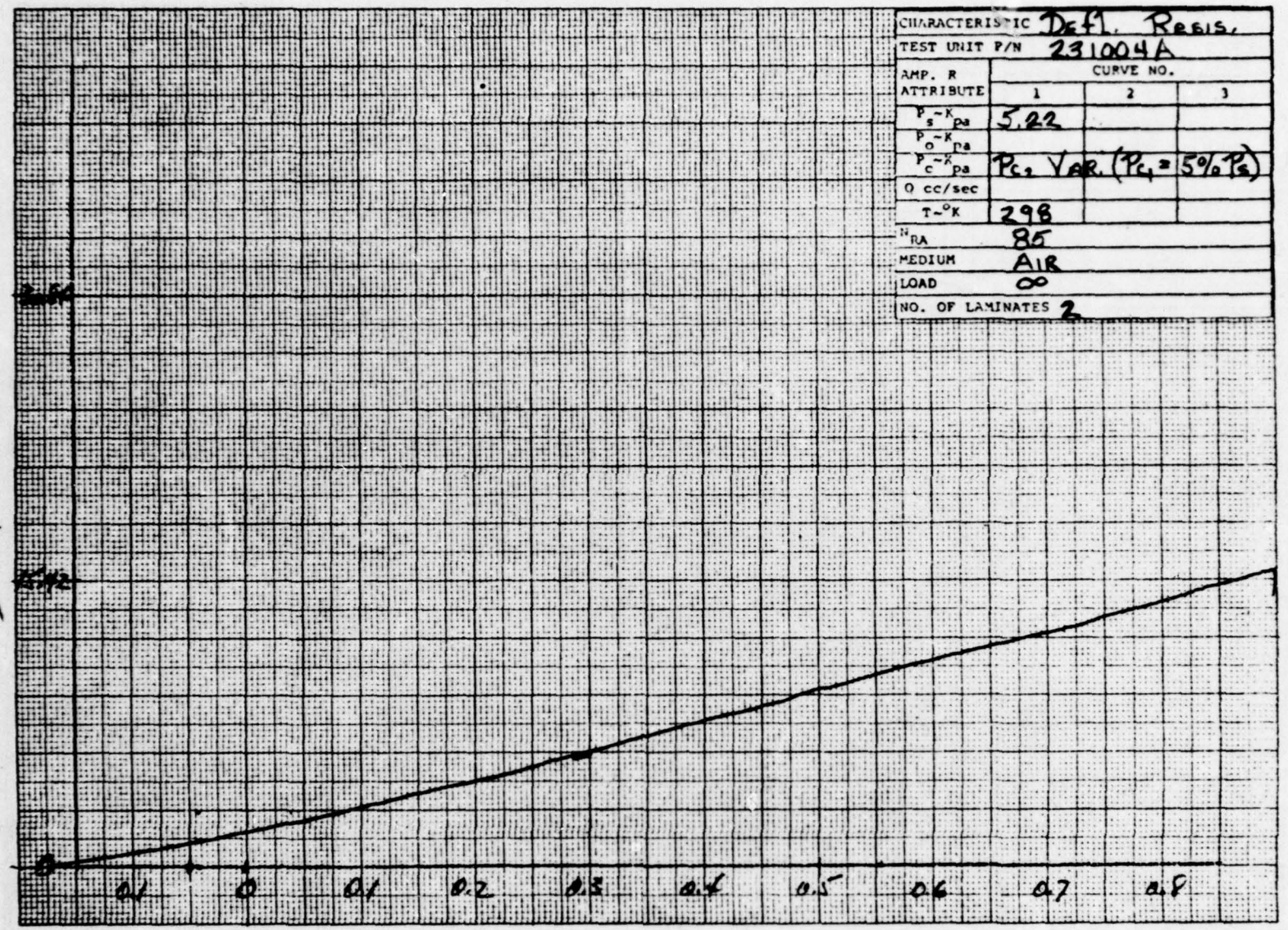

CHARACTERISTIC Input Imped. CH. I
TEST UNIT P/N 23 1004A (2260)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
7.95
7.95
7.95
$P_o$~K pa
$P_c$~K pa
VARIABLE →
Q cc/sec
T~°K
298
353
408
$N_{RA}$
MEDIUM AIR
LOAD 23 1004A
NO. OF LAMINATES 2
13.90
11.12
8.34
5.56
2.78
0
0.25
0.5
0.75
1.0
1.25
1.5
1.75
2.0
Qcz , m³/sec X10⁷
Pcz , kPa

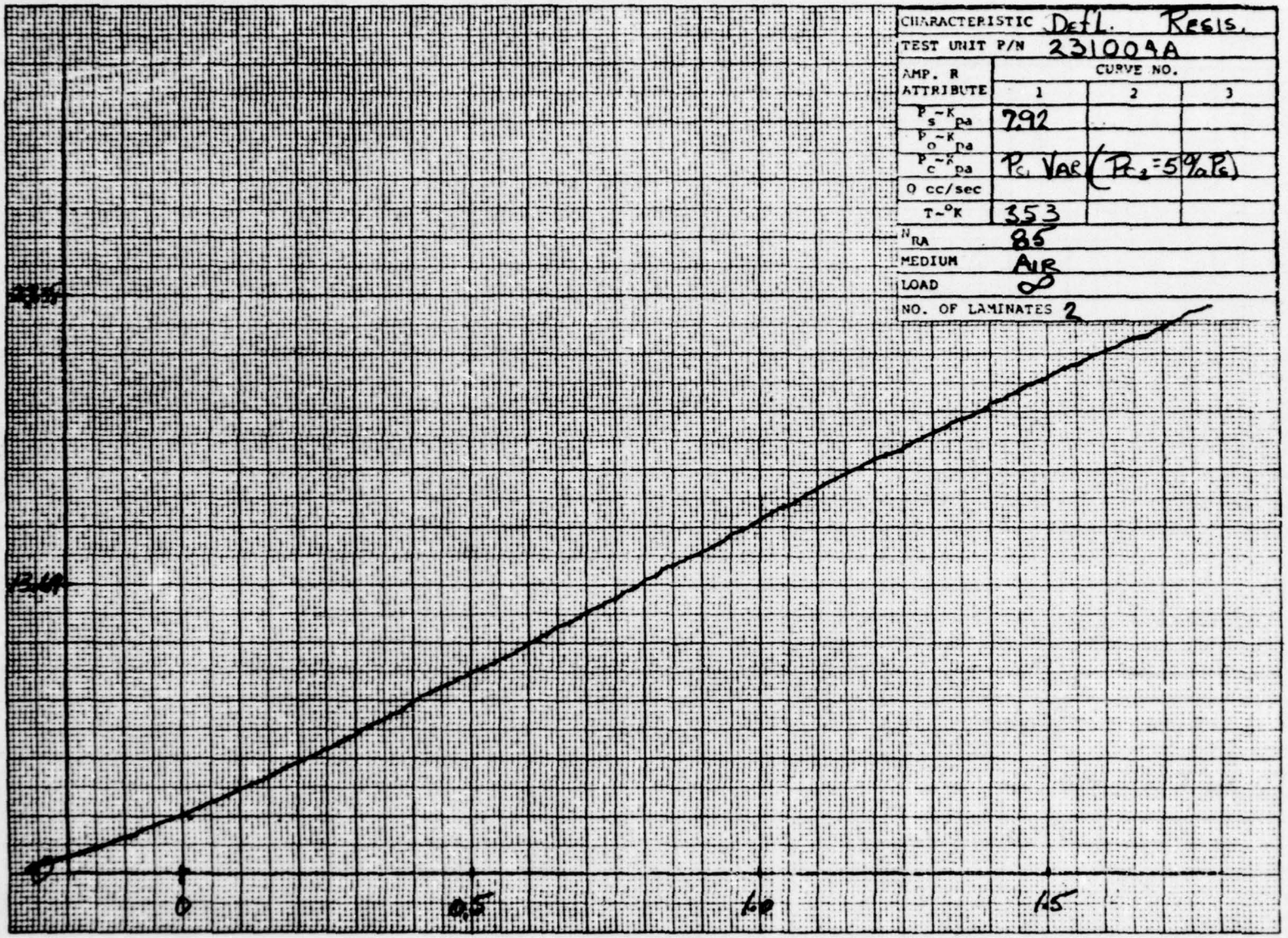

CHARACTERISTIC Input Imped. Ckt
TEST UNIT P/N 231004A (2260)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa 7.95 7.95 7.95
$P_o$~Kpa
$P_c$~Kpa VARIABLE →
Q cc/sec
T~°K 298 353 408
$N_{RA}$ —
MEDIUM AIR
LOAD 231004A
NO. OF LAMINATES 2
16.68
13.90
11.12
8.34
5.56
2.78
0
0.25
0.5
1.0
1.25
1.5
1.75
2.0
$Q_{c1}$, $m^3/sec \times 10^7$
$P_{c1}$, kPa


CHARACTERISTIC Input Imped, CVI
TEST UNIT P/N 231004A (2260)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa 1.98 1.98 1.98
$P_o$~Kpa
$P_c$~Kpa VARIABLE →
Q cc/sec
T~°K 298 353 408
$N_{RA}$ —
MEDIUM AIR
LOAD 231004A
NO. OF LAMINATES 2
$P_{c_1}$, $m^3$/sec x $10^7$
8.34
5.56
2.78
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
$P_{c_1}$, kPa

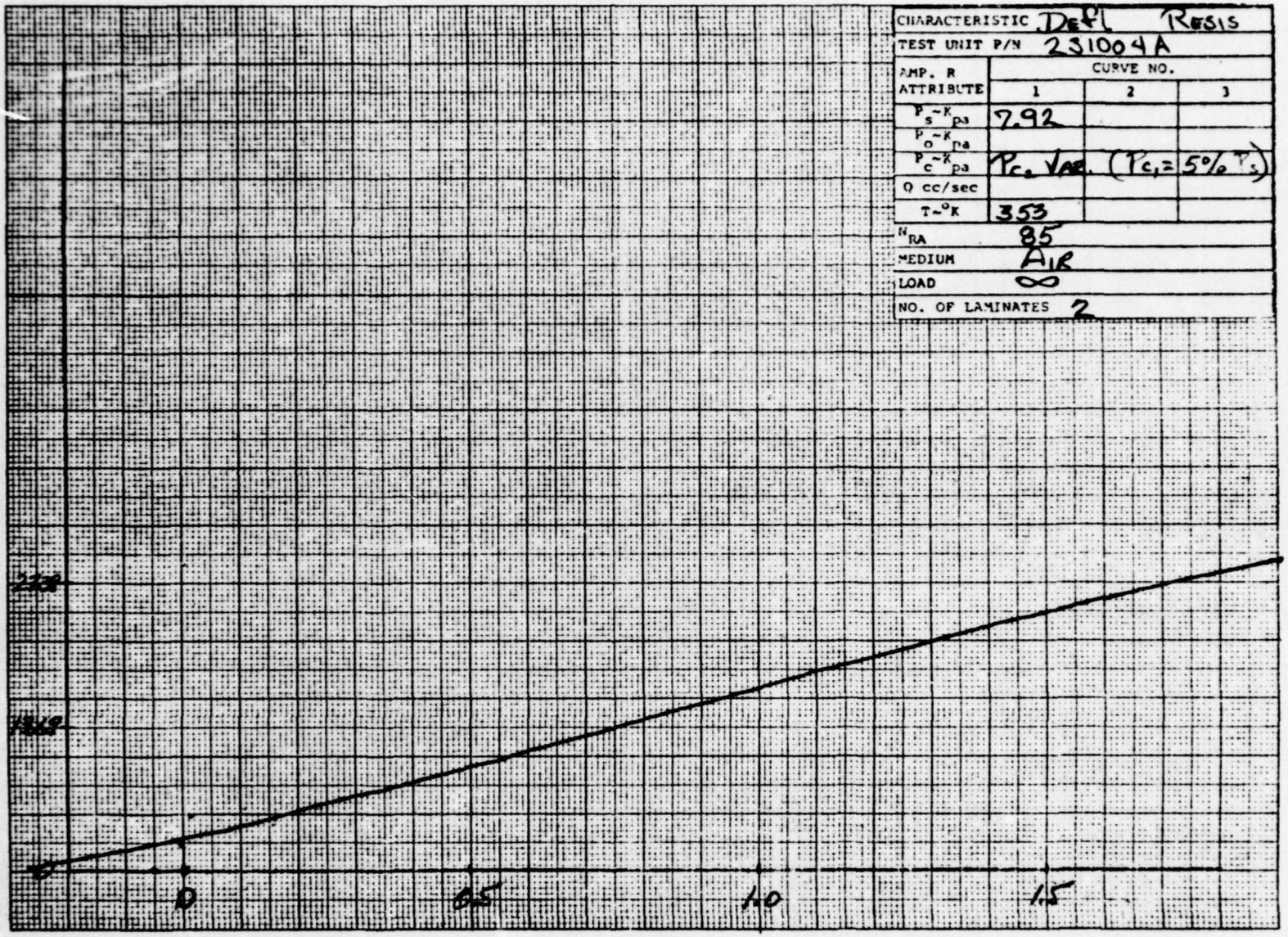

CHARACTERISTIC Input Impd. C.N.T.
TEST UNIT P/N 231004A1
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$ ~K pa 1.98 1.98 1.98
$P_o$ ~K pa
$P_c$ ~K pa Variable →
Q cc/sec
T ~°K 298 353 408
$N_{RA}$ —
MEDIUM Air
LOAD 231004A
NO. OF LAMINATES 2
13.90
11.12
8.34
5.56
2.78
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
$Q_{c_2}$, $m^3/sec \times 10^7$
$P_{c_2}$, kPa

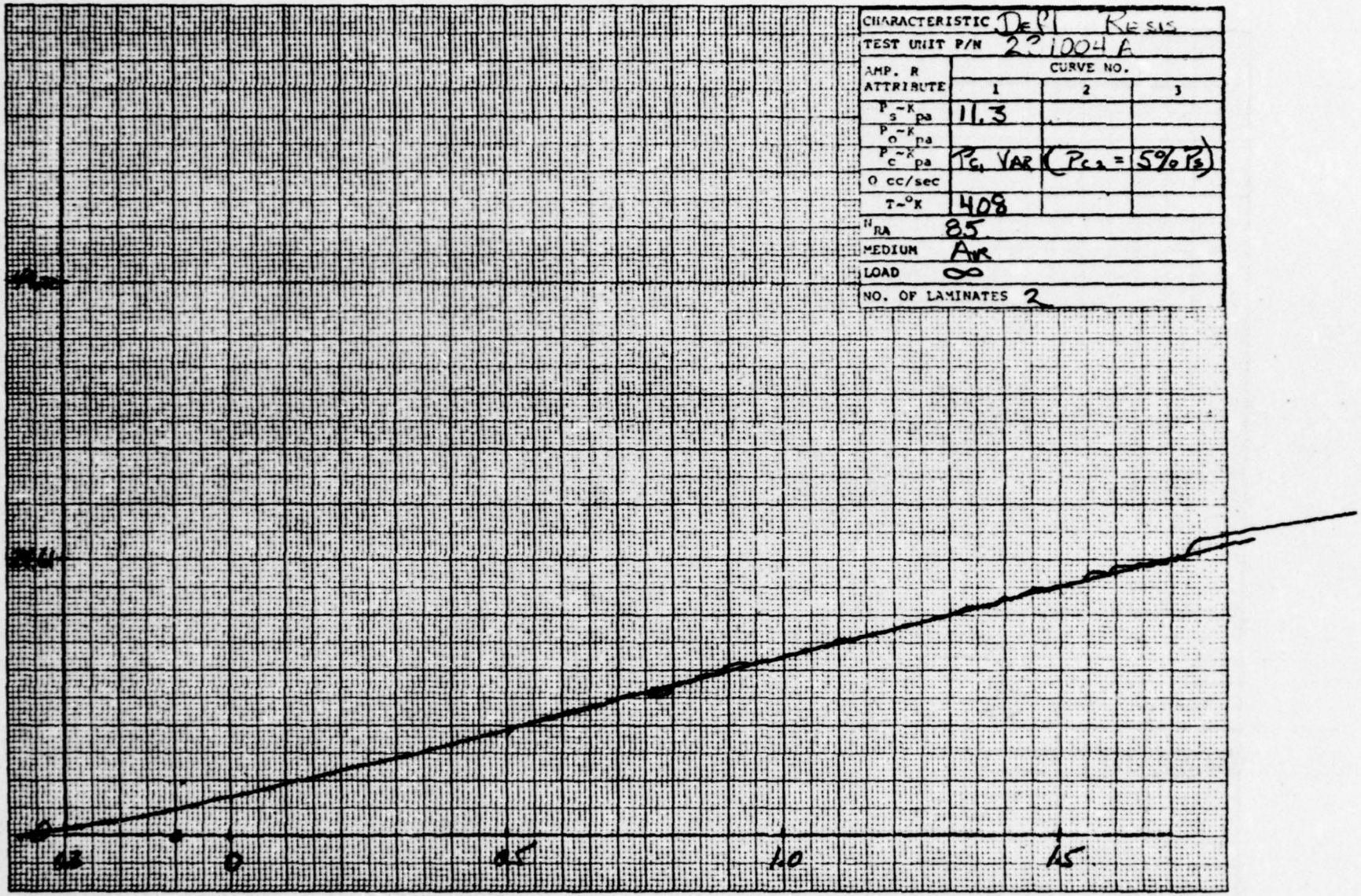

CHARACTERISTIC DEFL. RESIS
TEST UNIT P/N 2.31004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~K pa 5.22
$P_o$ ~K pa
$P_c$ ~K pa Pc. VAR (Pc2 = 5% Ps)
Q cc/sec
T ~°K 298
$N_{RA}$ 85
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
-0.10
0
0.25
0.50
0.75
0.90
ΔPc
Qc1, m³/sec x10⁷

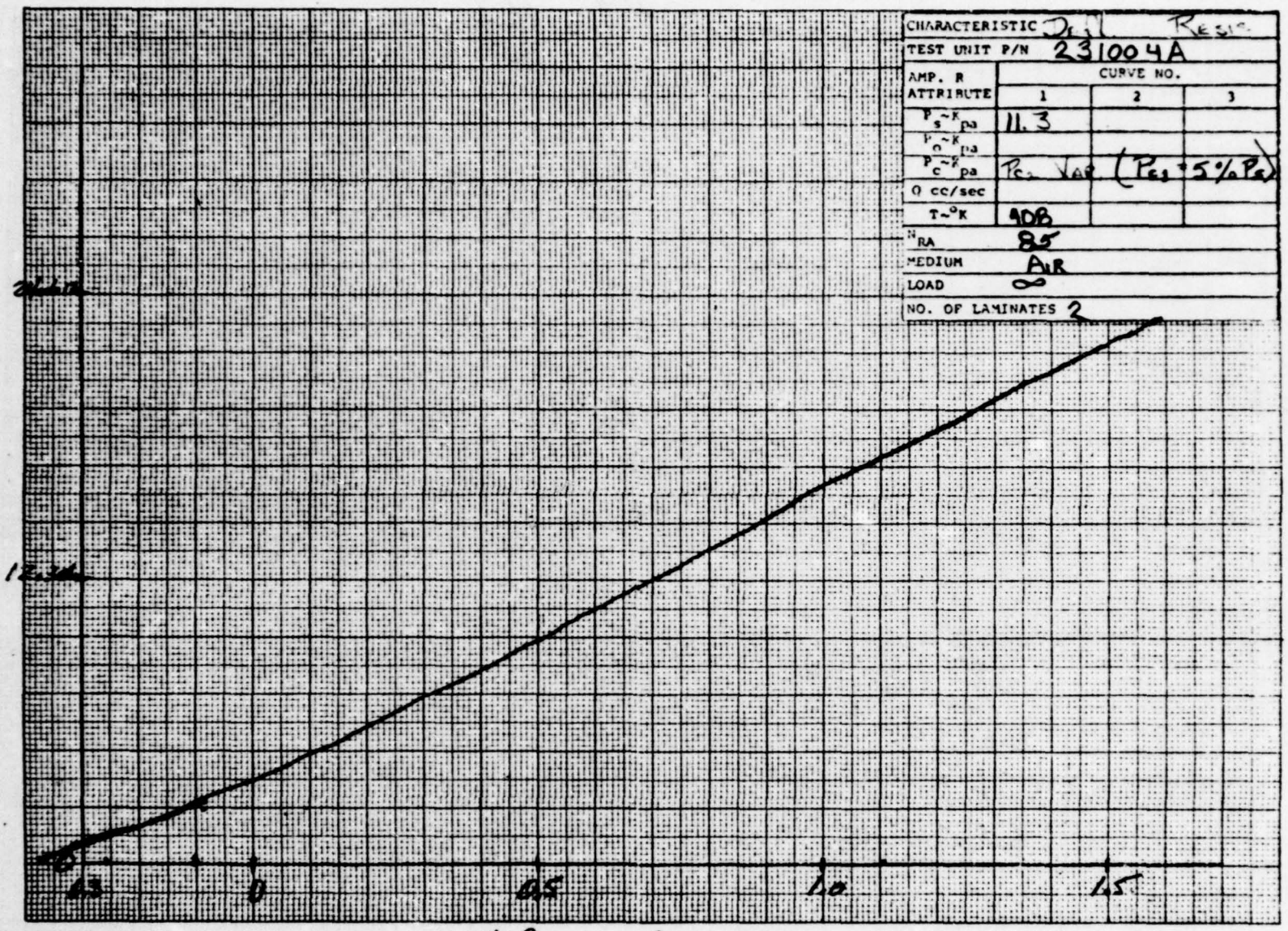

CHARACTERISTIC Def. Resis.
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~$K_{pa}$ 5.22
$P_o$~$K_{pa}$
$P_c$~$K_{pa}$ $P_{c_2}$ VAR. ($P_{c_1}$ = 5% $P_s$)
Q cc/sec
T~°K 298
$N_{RA}$ 85
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
$Q_{cz}$, $M^3$/SEC X $10^7$
0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
$\Delta P_c$, kPa

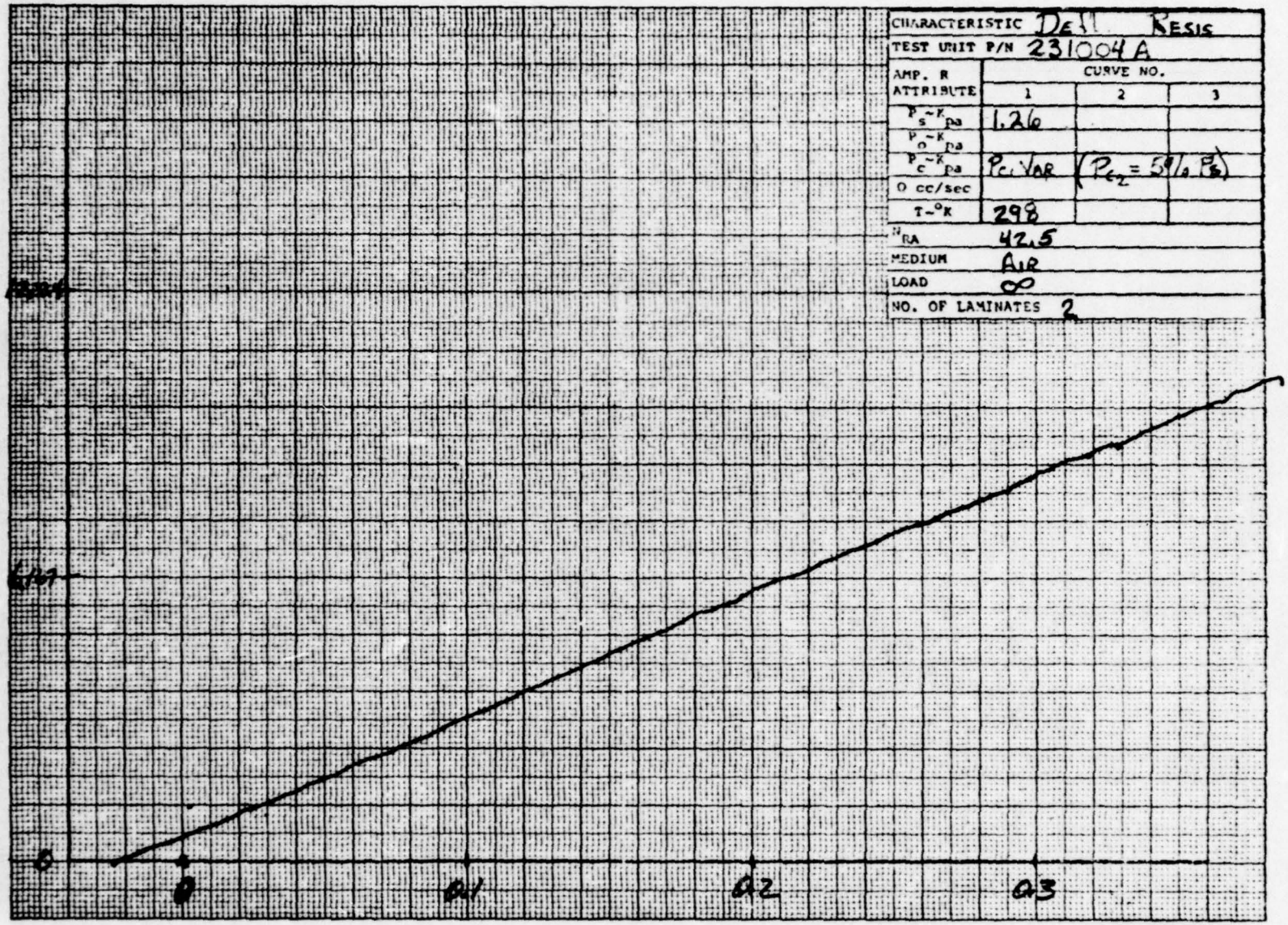

CHARACTERISTIC Defl. Regis.
TEST UNIT P/N 231009A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~ K Pa
7.92
$P_o$ ~ K Pa
$P_c$ ~ K Pa
$P_{c_1}$ VAR ($P_{c_2}$ = 5% $P_{c_1}$)
Q cc/sec
T ~ °K
353
$N_{RA}$
85
MEDIUM
AIR
LOAD
∞
NO. OF LAMINATES 2
0
0.5
1.0
1.5
$Q_{c_1}$, $m^3$/sec x $10^7$
$\Delta P_c$, kPa

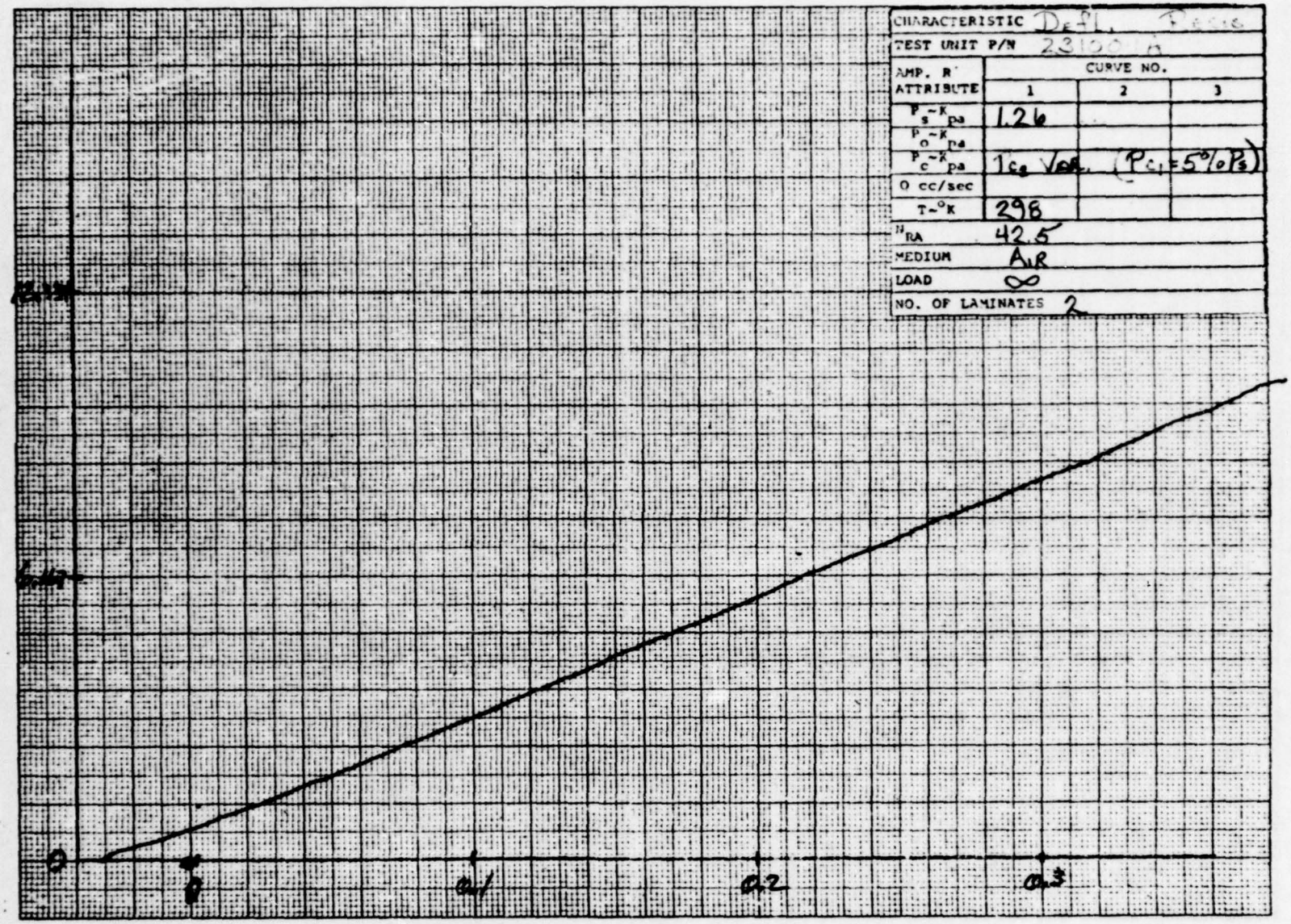
343


CHARACTERISTIC Def. Resis
TEST UNIT P/N 231004A
AMP. R
ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
7.92
$P_o$~K pa
$P_c$~K pa
$P_{c_2}$ Var. ($P_{c_1}$ = 5% $P_s$)
Q cc/sec
T~°K
353
$N_{RA}$
85
MEDIUM
AIR
LOAD
∞
NO. OF LAMINATES
2
$Q_{c_2}$, $m^3$/sec x $10^7$
0
0.5
1.0
1.5
$\Delta P_c$, kPa


CHARACTERISTIC DEFL RESN
TEST UNIT P/N 22 1004 A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$-K pa
11.3
$P_o$-K pa
$P_c$-K pa
$P_{c_1}$ VAR ($P_{c_2}$ = 5% $P_s$)
0 cc/sec
T-°K
408
$N_{RA}$
8.5
MEDIUM
AIR
LOAD
∞
NO. OF LAMINATES
2
$Q_{c_1}$, $m^3$/sec X $10^7$
-.5
0
.5
1.0
1.5
$\Delta P_c$, kPa

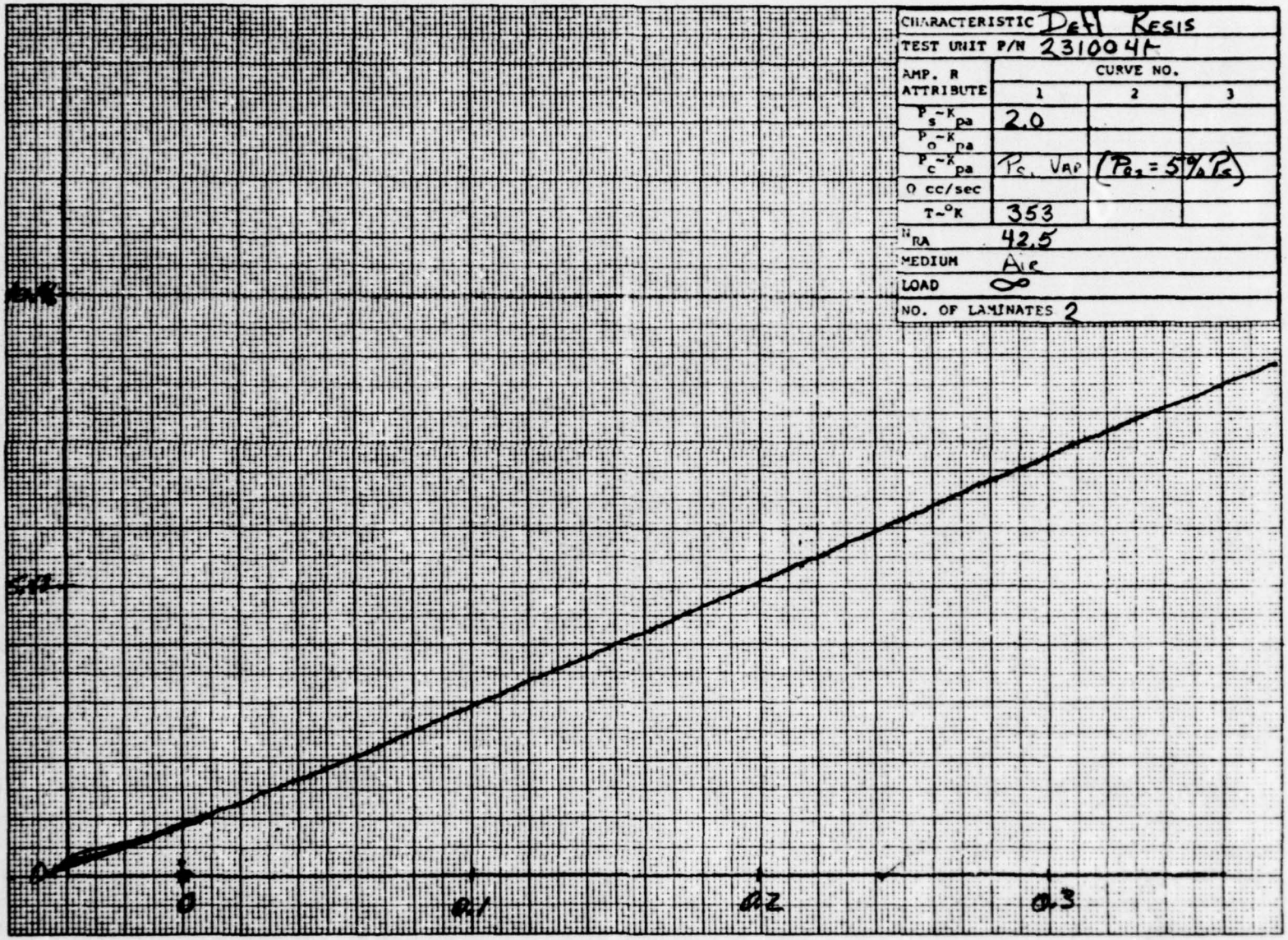

CHARACTERISTIC Dest Resis.
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa 11.3
$P_o$~Kpa
$P_c$~Kpa Pcr Var (Pcr ± 5% Pcr)
Q cc/sec
T~°K 408
$N_{RA}$ 85
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
Qcr, m³/sec x10⁷
ΔPc, kPa
-.5
0
.5
1.0
1.5

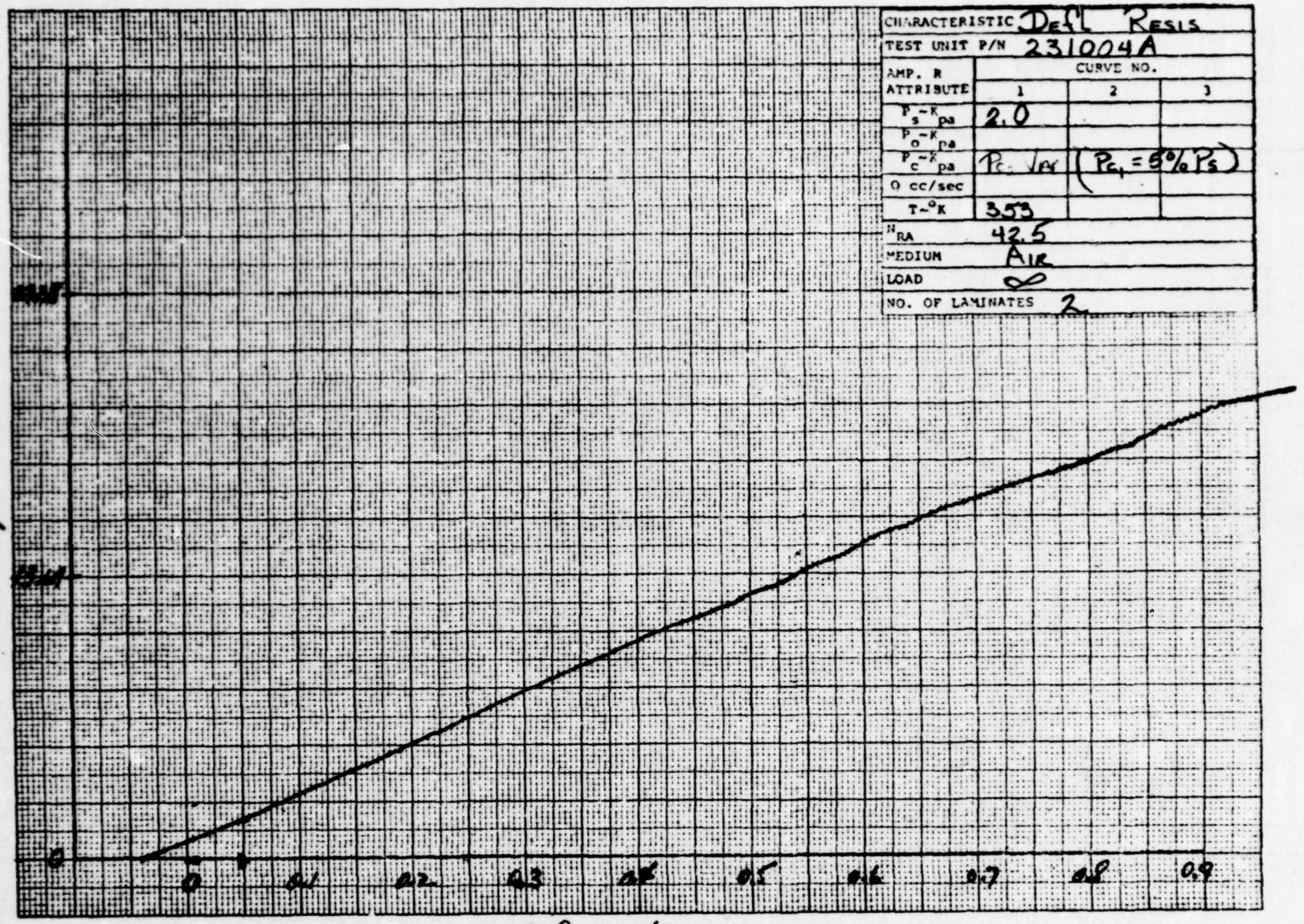

CHARACTERISTIC DEFL RESIS
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~K pa
1.26
$P_o$ ~K pa
$P_c$ ~K pa
$P_{c1}$ VAR ($P_{c2}$ = 5% $P_s$)
Q cc/sec
T ~°K
298
$N_{RA}$
42.5
MEDIUM
AIR
LOAD
∞
NO. OF LAMINATES
2
$Q_{c1}$, $m^3$/sec x10
0
Δ1
Δ2
Δ3
ΔPc, kPa



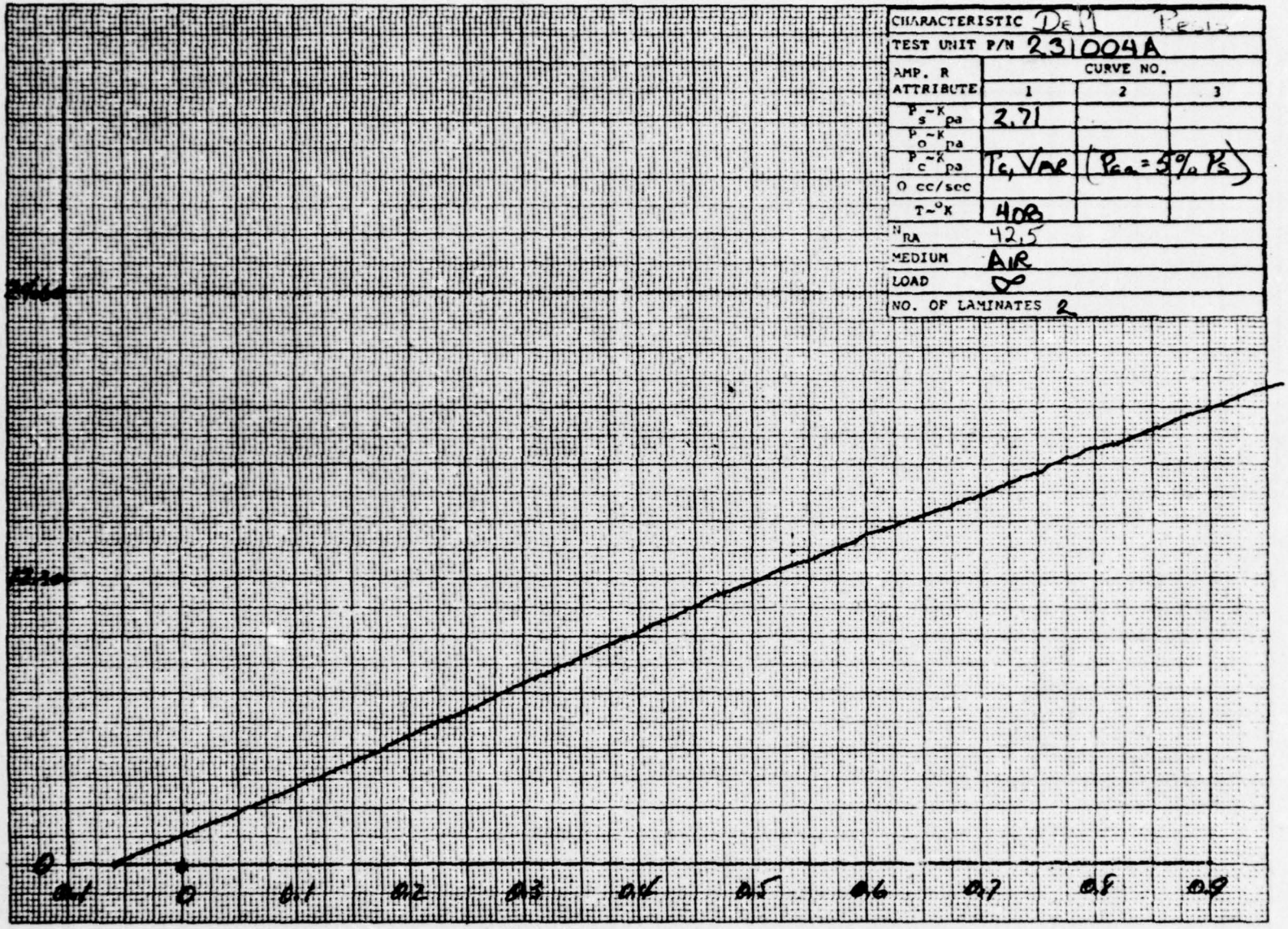

348

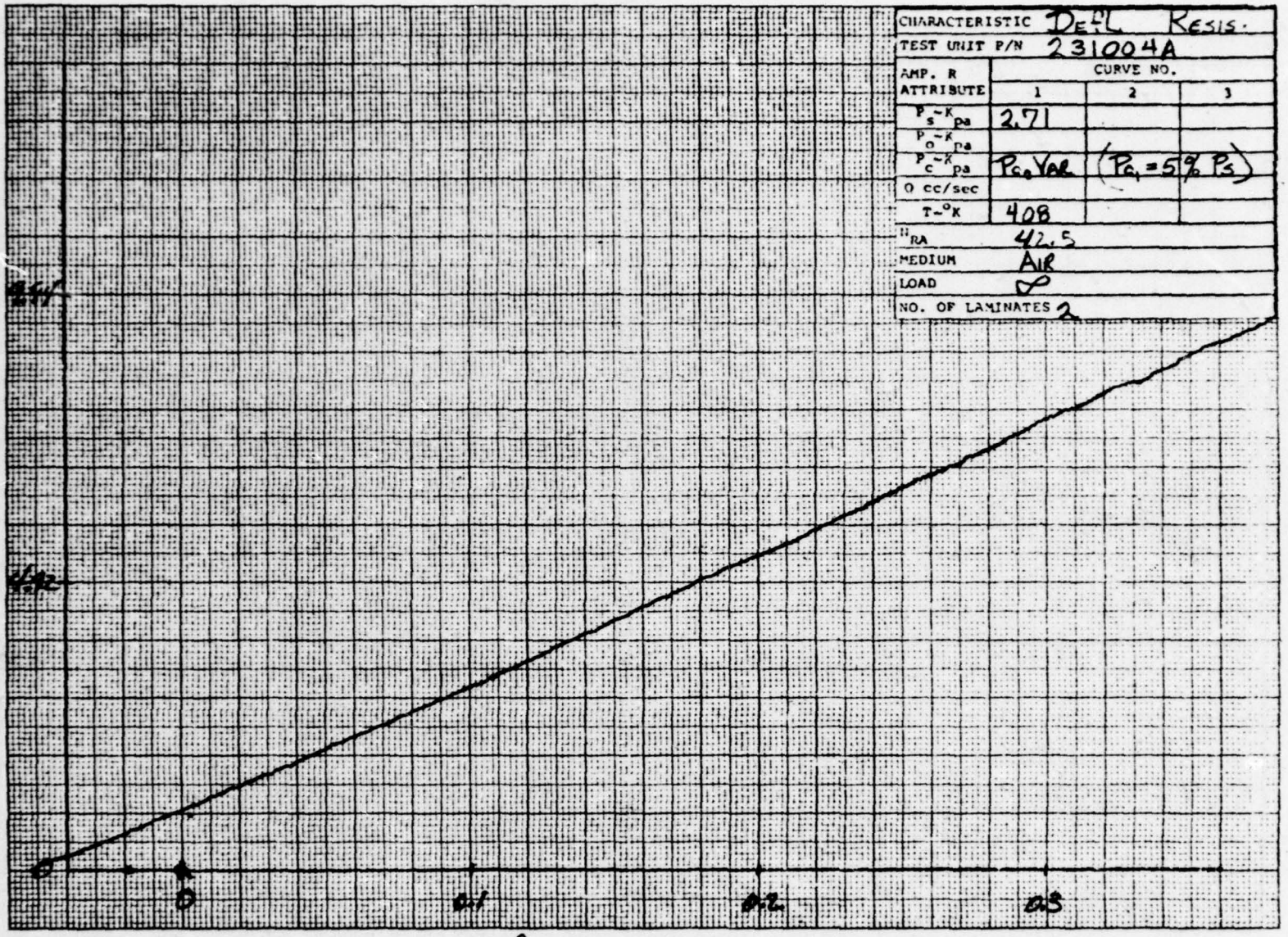
CLEARPRINT PAPER CO. NO. C38 MILLIMETERS BOTH WAYS 100 X 130 DIVISIONS
PRINTED IN U.S.A. ON CLEARPRINT TECHNICAL PAPER NO. 1018

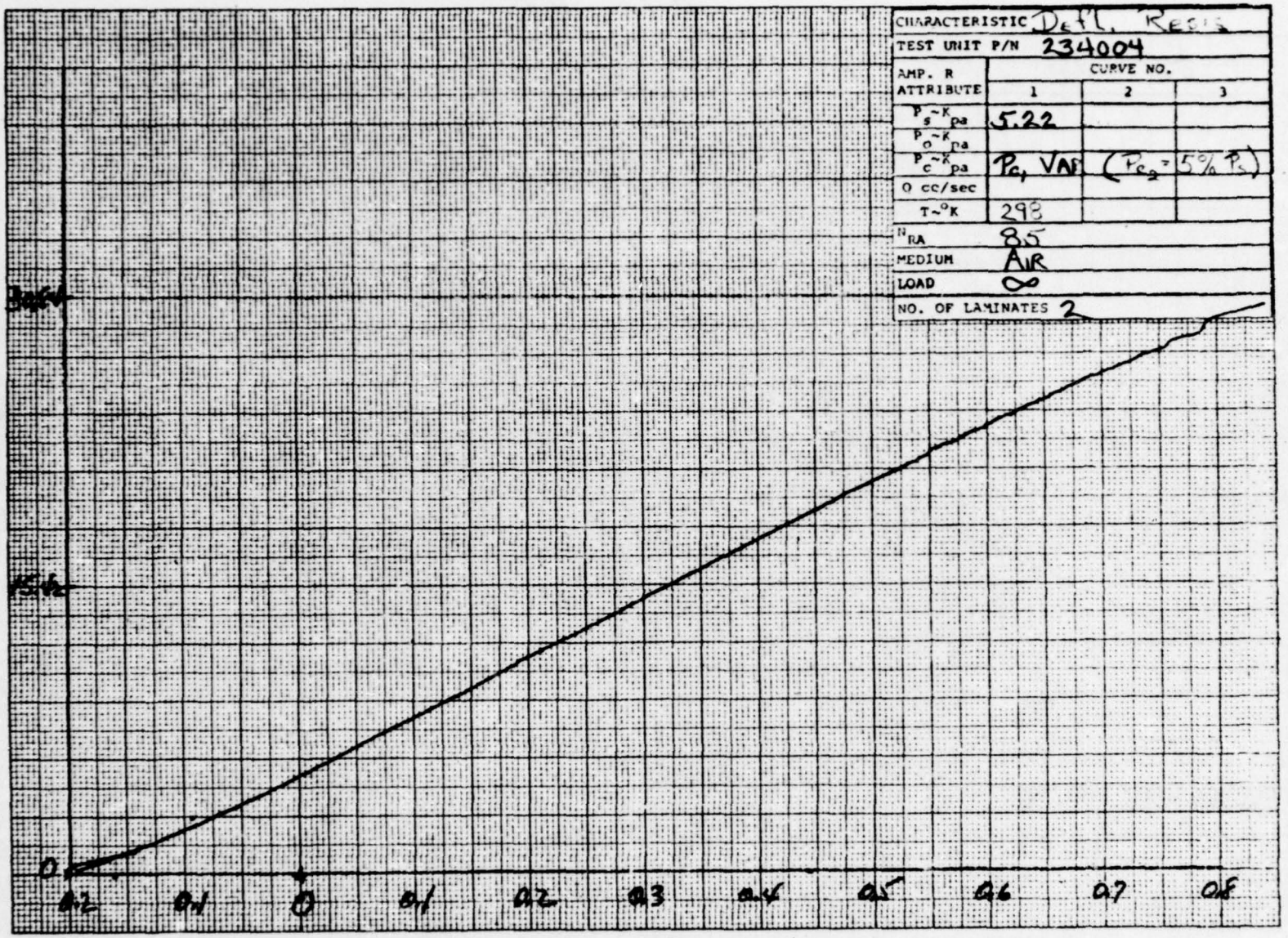

CHARACTERISTIC Def Resis
TEST UNIT P/N 231004-
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa 2.0
$P_o$~Kpa
$P_c$~Kpa $P_{s,VAP}$ ($P_{O_2}$ = 5% $P_a$)
Q cc/sec
T~°K 353
$N_{RA}$ 42.5
MEDIUM Air
LOAD ∞
NO. OF LAMINATES 2
$Q_{C1}$, $m^3$/sec x $10^7$
$\Delta P_C$, kPa
0
0.1
0.2
0.3

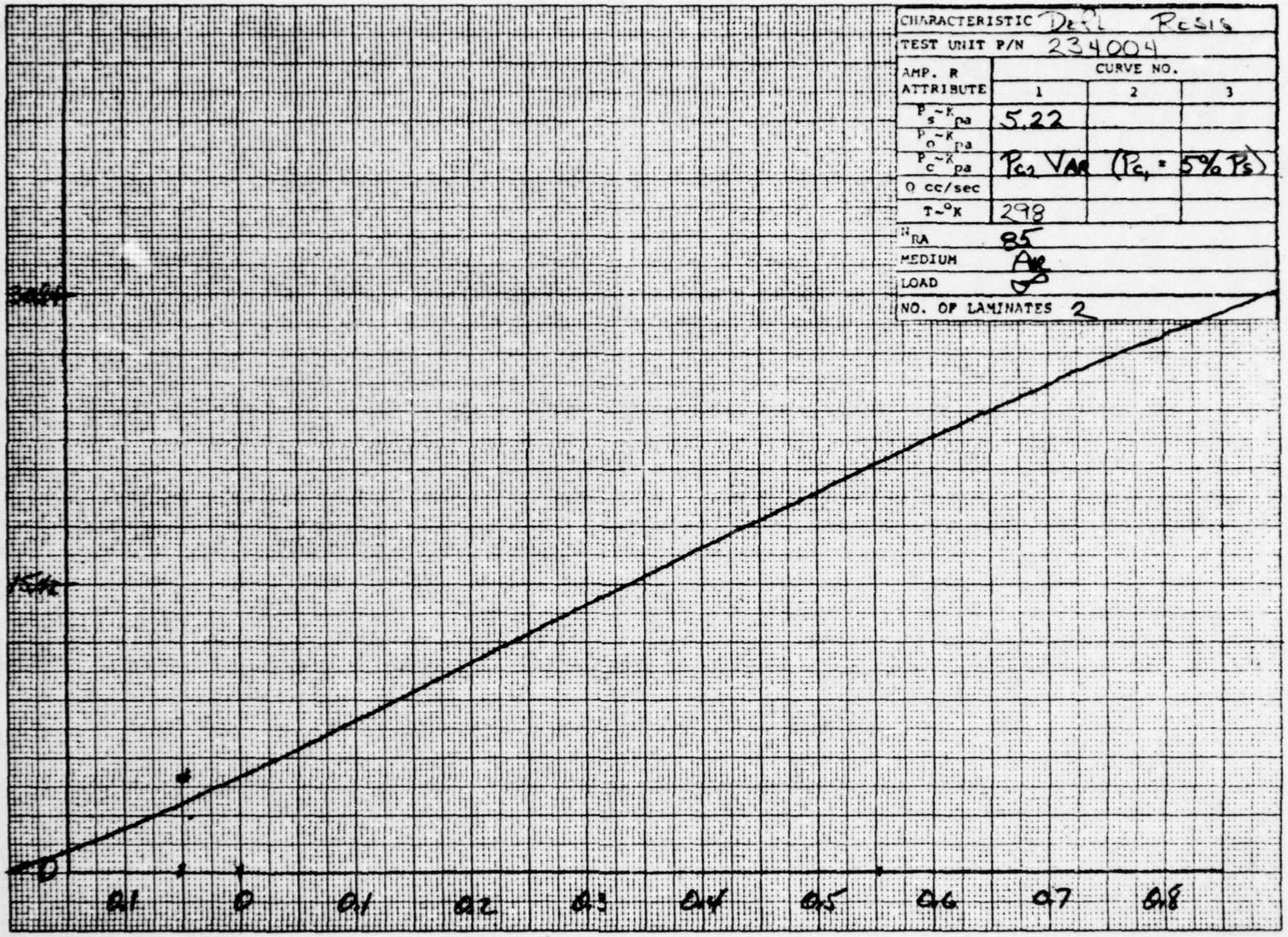

CHARACTERISTIC Def'l Resis
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
2.0
$P_o$~K pa
$P_c$~K pa
$P_c$ var ($P_{c_1}$ = 5% $P_s$)
Q cc/sec
T~°K
353
$N_{RA}$
42.5
MEDIUM
Air
LOAD
∞
NO. OF LAMINATES
2
$Q_{c_2}$, $m^3$/sec x $10^{-1}$
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
$\Delta P_c$, kPa

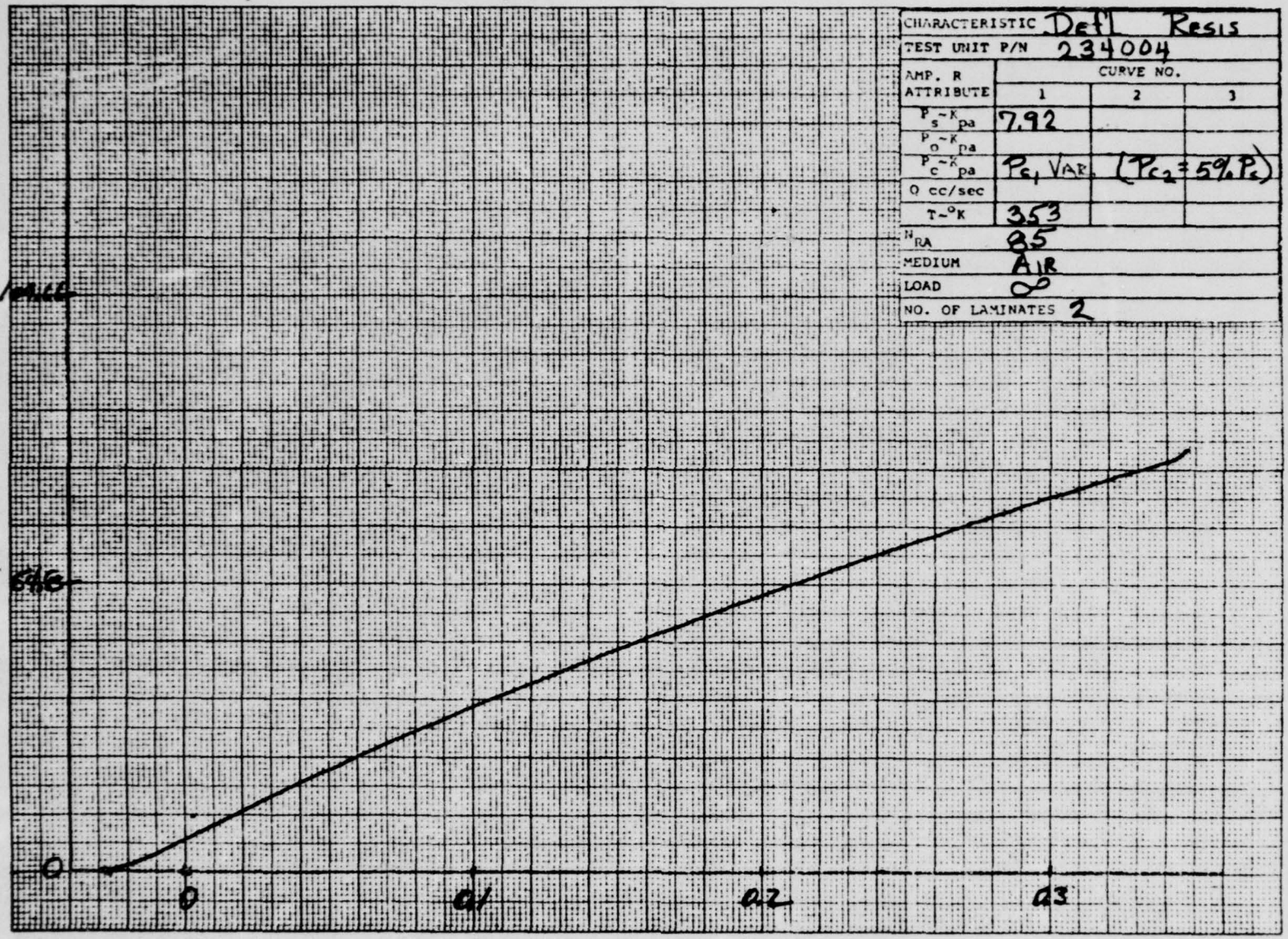
350

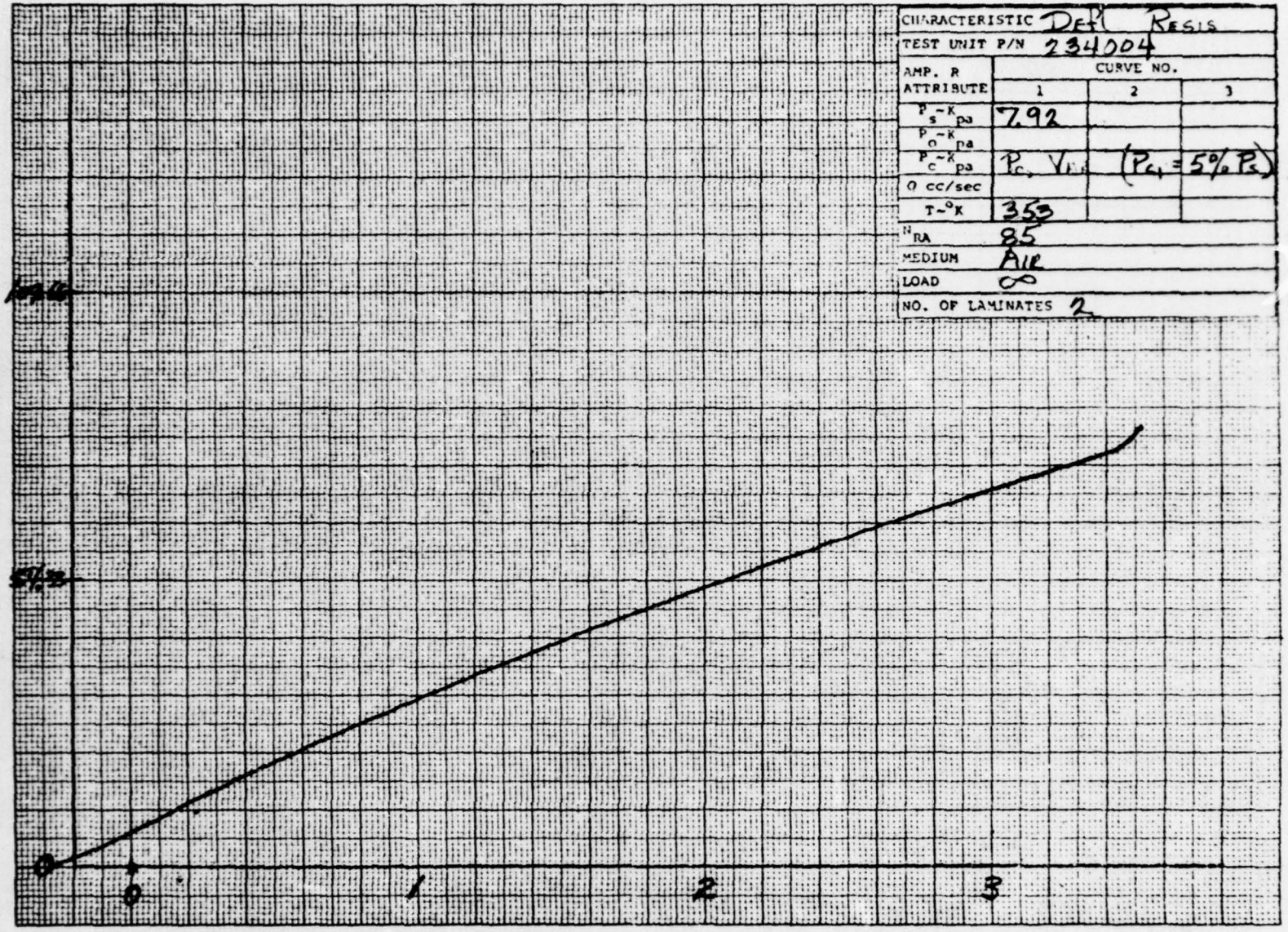

CHARACTERISTIC DELTA P FLOW
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ - K pa
2.71
$P_o$ - K pa
$P_c$ - K pa
$T_c$, VAR ($P_{ca}$ = 5% $P_s$)
0 cc/sec
T - °K
408
$N_{RA}$
42.5
MEDIUM
AIR
LOAD
∞
NO. OF LAMINATES
2
$Q_{c1}$, $m^3$/sec X $10^7$
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
$\Delta P_c$, kPa

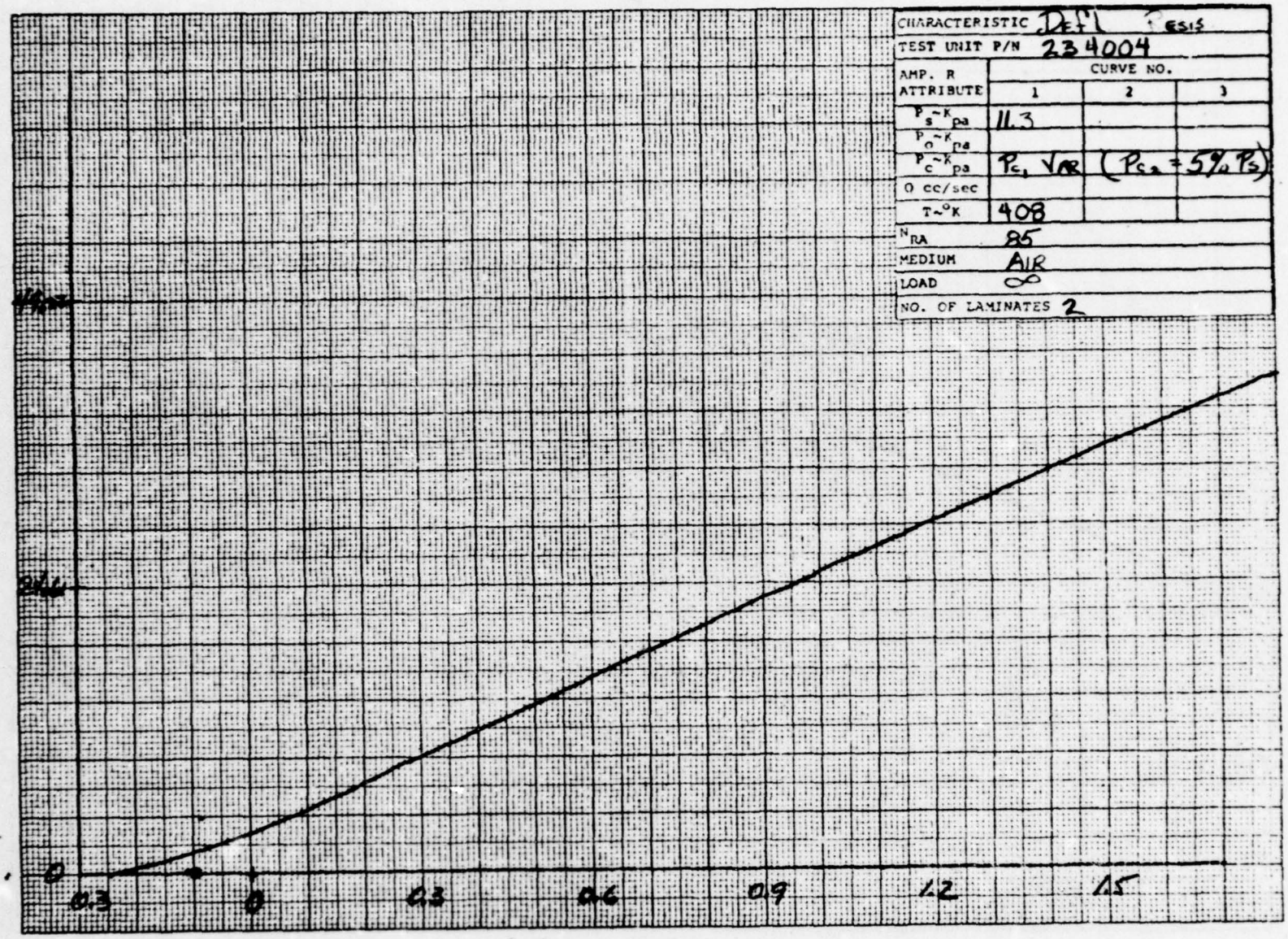

CHARACTERISTIC DEL. RESIS.
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~ K pa 2.71
$P_o$ ~ K pa
$P_c$ ~ K pa $P_{c_0}$ VAR ($P_{c_1}$ = 5% $P_s$)
0 cc/sec
T ~ °K 408
$^{11}$RA 42.5
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
$Q_{c_2}$, $m^3$/sec x10
$\Delta P_c$, kPa

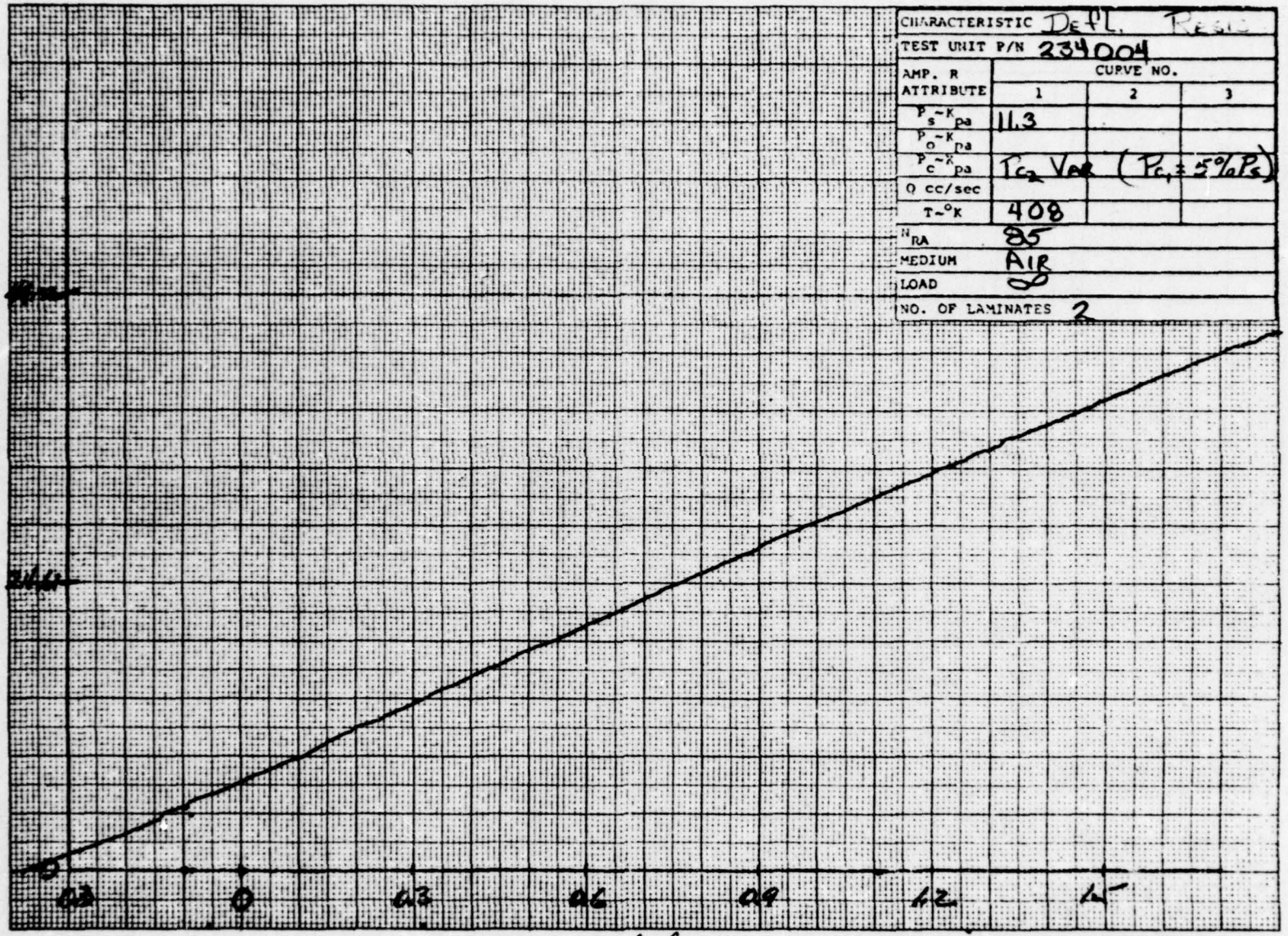

CHARACTERISTIC Def'l. Resis
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
5.22
$P_o$~K pa
$P_c$~K pa
Pc, VAR
($P_{c_2}$ = 5% $P_c$)
Q cc/sec
T~°K
298
$N_{RA}$
8.5
MEDIUM
AIR
LOAD
∞
NO. OF LAMINATES 2
$Q_{c_1}$, $m^3$/sec x $10^7$
$\Delta P_c$, kPa
0.2
0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8

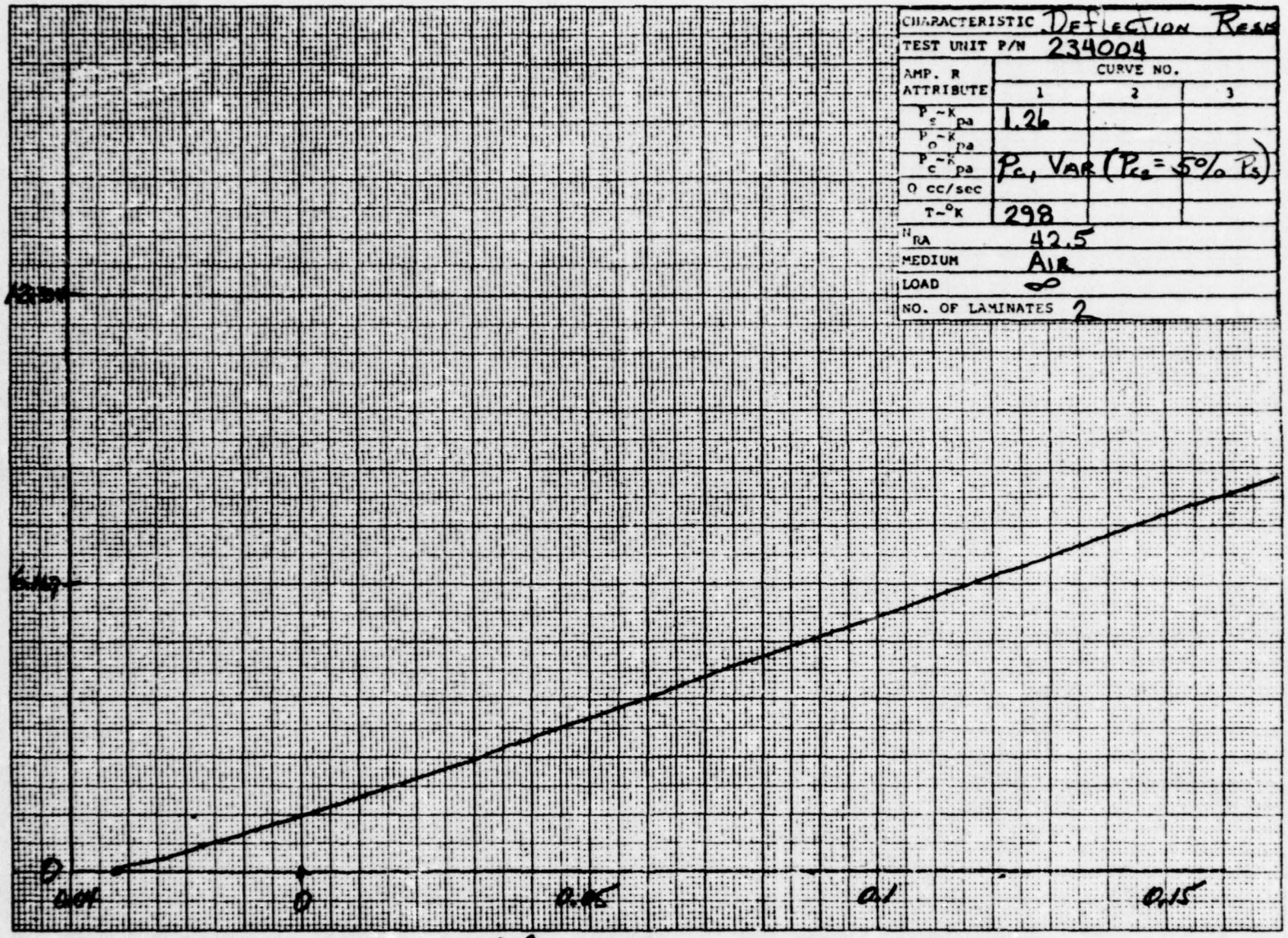

CHARACTERISTIC Dest Resis
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s \sim K_{pa}$ 5.22
$P_o \sim K_{pa}$
$P_c \sim K_{pa}$ Pc2 VAR (Pc1 = 5% Ps)
Q cc/sec
T ~ °K 298
$N_{RA}$ 85
MEDIUM Air
LOAD 0
NO. OF LAMINATES 2
Qc2, m³/sec x10⁷
0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
ΔPc, kPa

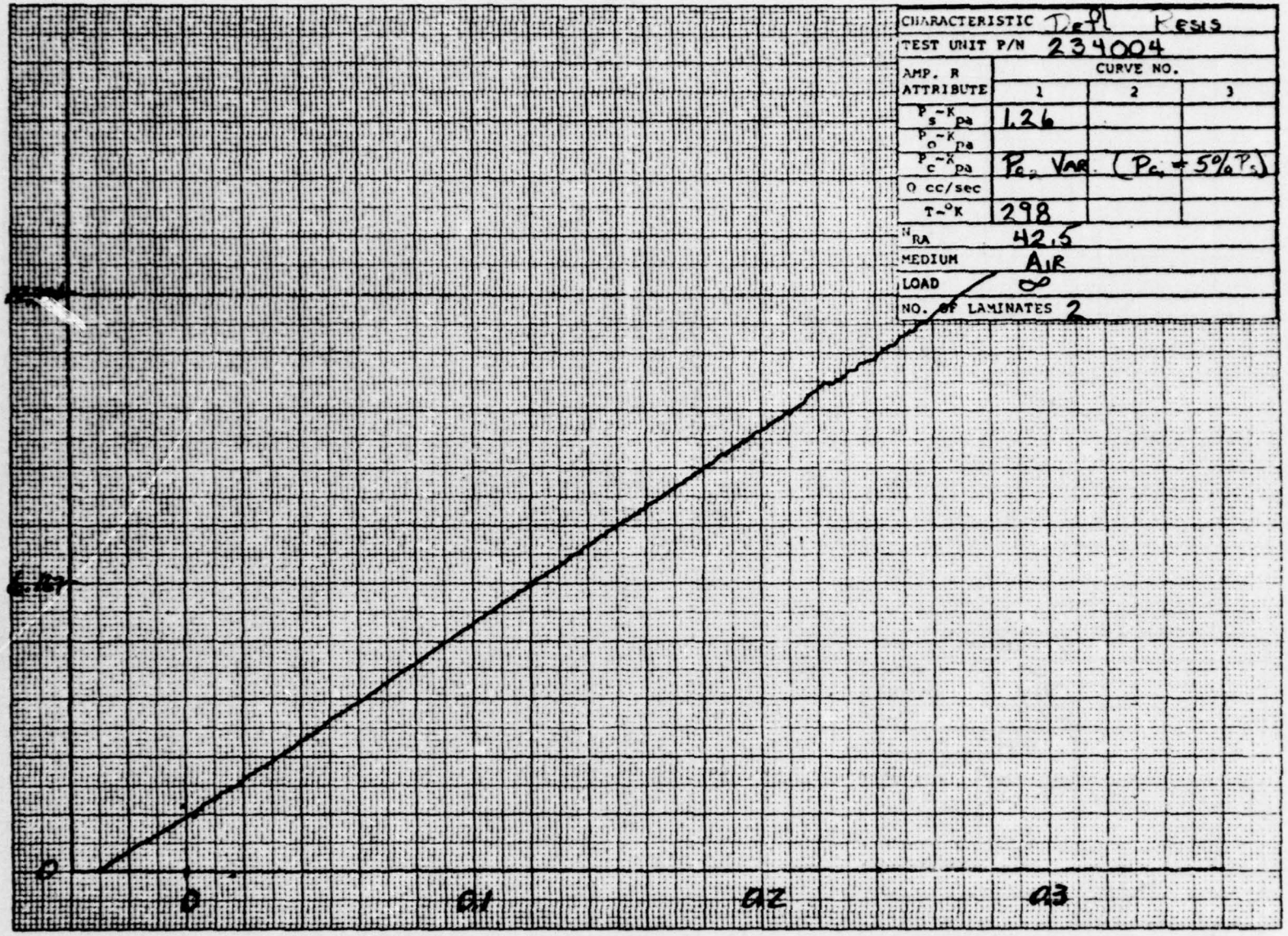

CHARACTERISTIC Defl Resis
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~Kpa 7.92
$P_o$~Kpa
$P_c$~Kpa $P_{c_1}$ VAR. ($P_{c_2}$ = 5% $P_c$)
Q cc/sec
T~°K 353
$N_{RA}$ 95
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
$Q_{e_1}$, $m^3$/sec X $10^7$
0
$\Delta P_c$, kPa
0
$a_1$
$a_2$
$a_3$

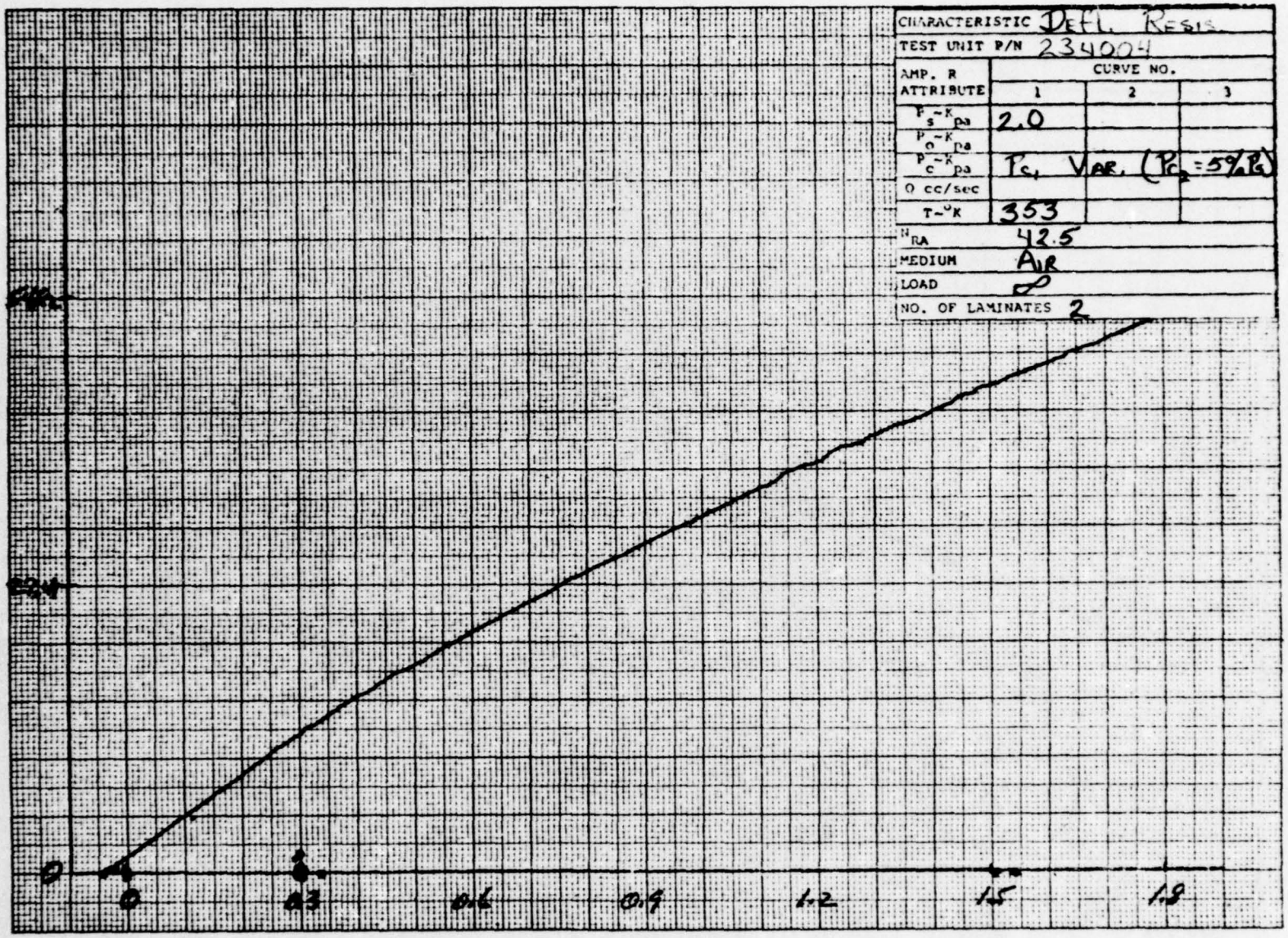

CHARACTERISTIC Def'l Resis
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ - Kpa 7.92
$P_o$ - Kpa
$P_c$ - Kpa $P_c$, $V_{t_1}$ ($P_{c_1}$ = 5% $P_c$)
Q cc/sec
T - °K 353
$N_{RA}$ 85
MEDIUM Air
LOAD ∞
NO. OF LAMINATES 2
0
1
2
3
$Q_{a_2}$, $m^3$/Sec X $10^7$
$\Delta P_c$, kPa

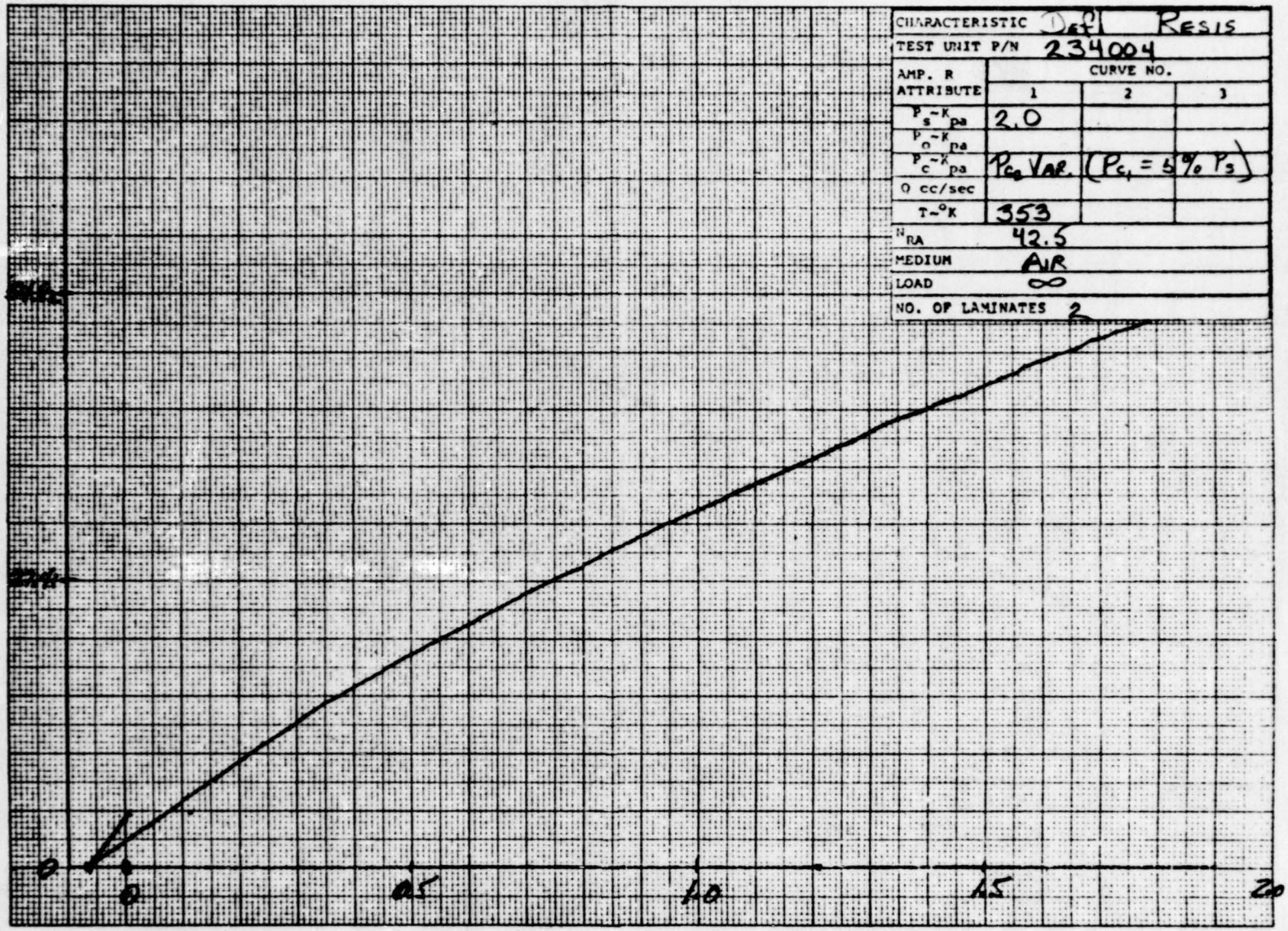

CHARACTERISTIC DEFL ESIS
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~K pa 11.3
$P_o$ ~K pa
$P_c$ ~K pa $P_{c_1}$ VAR ($P_{c_2}$ = 5% $P_s$)
0 cc/sec
T ~°K 408
$N_{RA}$ 85
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
0
0.3
0
0.3
0.6
0.9
1.2
1.5
$Q_{c_1}$, $m^3$/sec X $10^7$
$\Delta P_c$, kPa

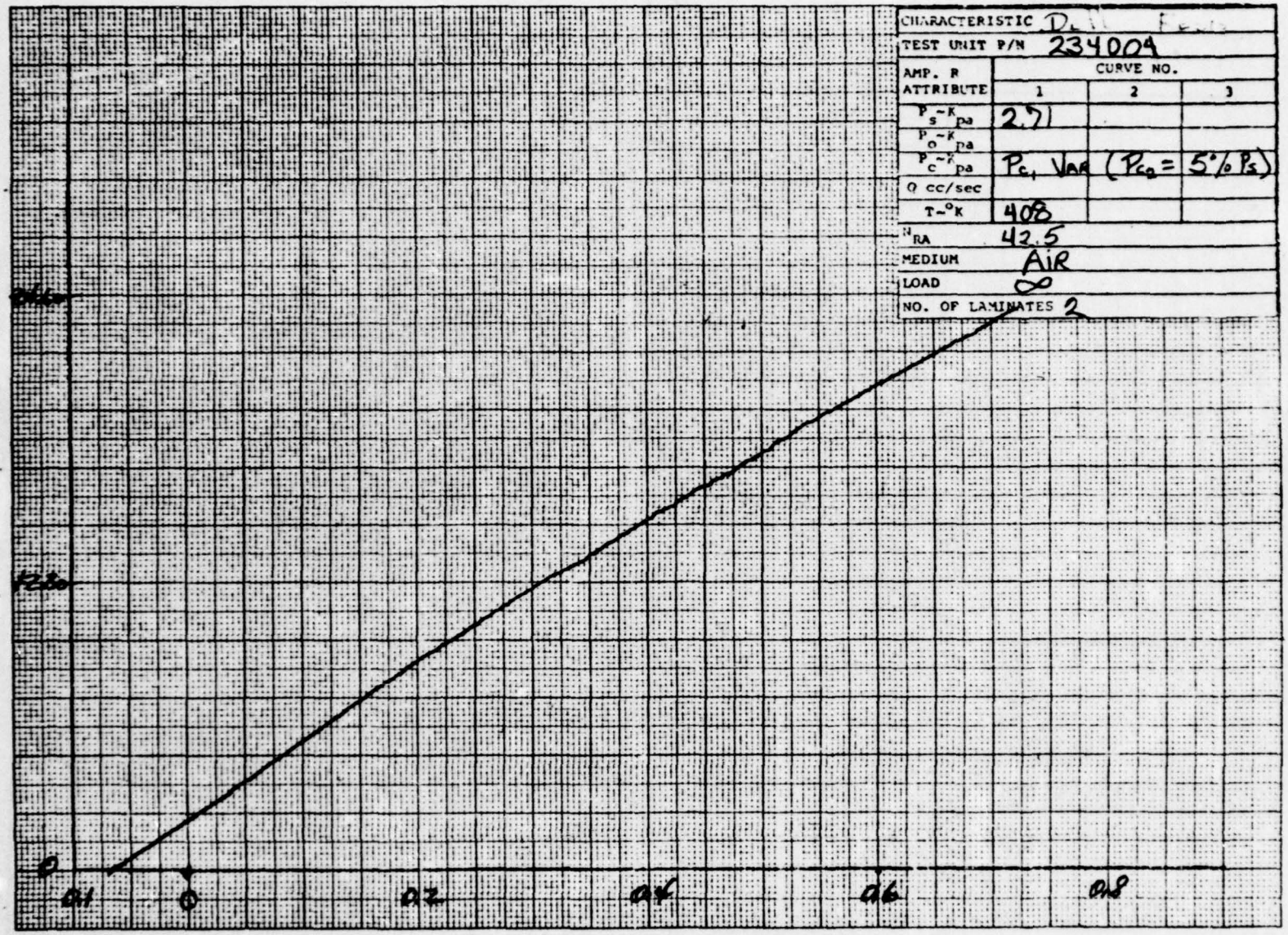

CHARACTERISTIC Def. Resp
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~ Kpa 11.3
$P_o$ ~ Kpa
$P_c$ ~ Kpa $P_{c_2}$ Var ($P_{c_1} \pm 5\% P_s$)
Q cc/sec
T ~ °K 408
$N_{RA}$ 85
MEDIUM AIR
LOAD 0
NO. OF LAMINATES 2
$Q_{c_2}$, $m^3$/sec X $10^7$
$\Delta P_c$, kPa

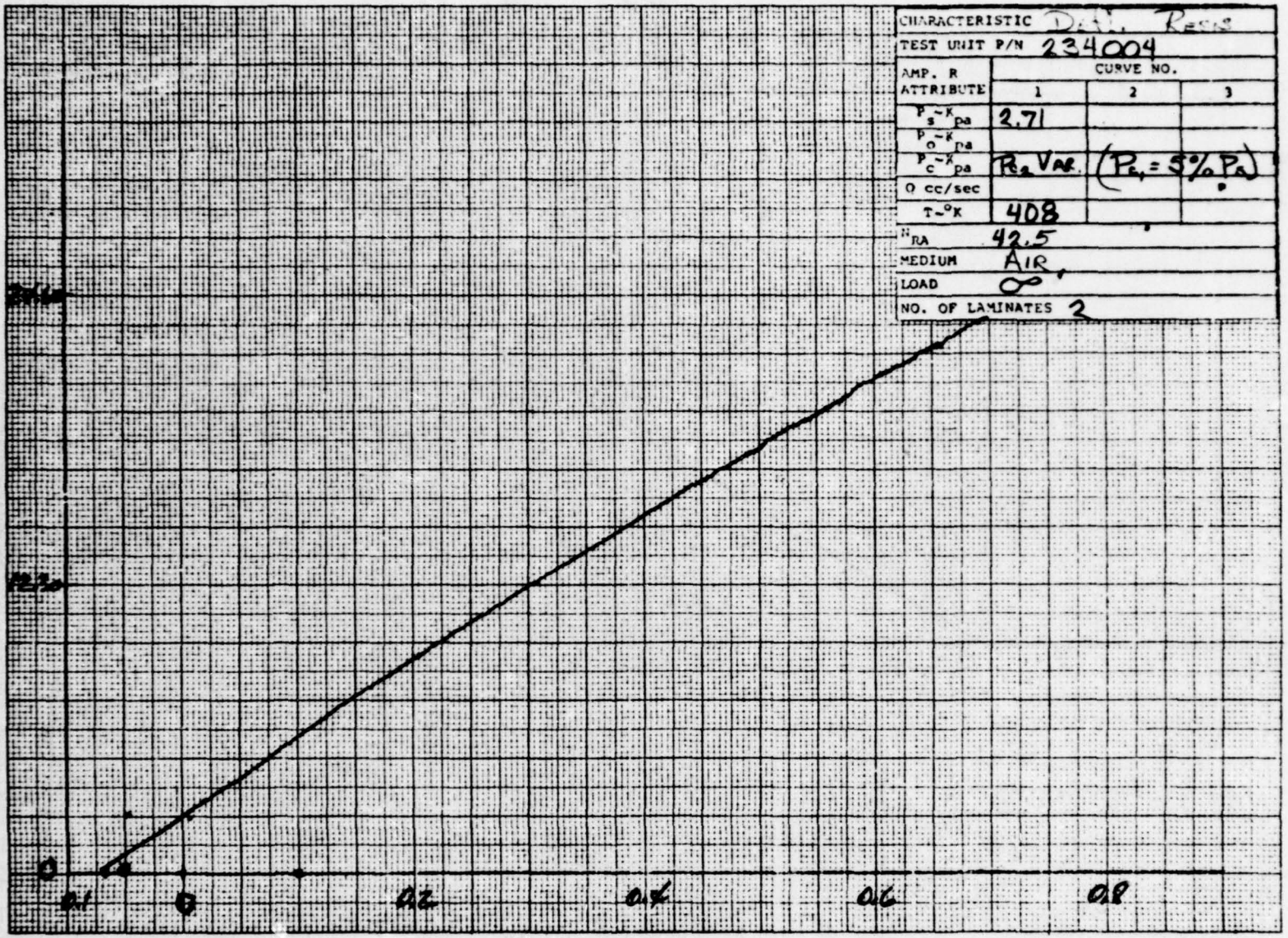

CHARACTERISTIC Deflection Rest
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$ ~ K pa 1.26
$P_o$ ~ K pa
$P_c$ ~ K pa $P_c$, VAR ($P_{cs}$ = 5% $P_s$)
Q cc/sec
T ~ °K 298
$N_{RA}$ 42.5
MEDIUM Air
LOAD ∞
NO. OF LAMINATES 2
Qcl, m³/sec X10⁷
0.05
0
0.05
0.1
0.15
Δpc, kPa

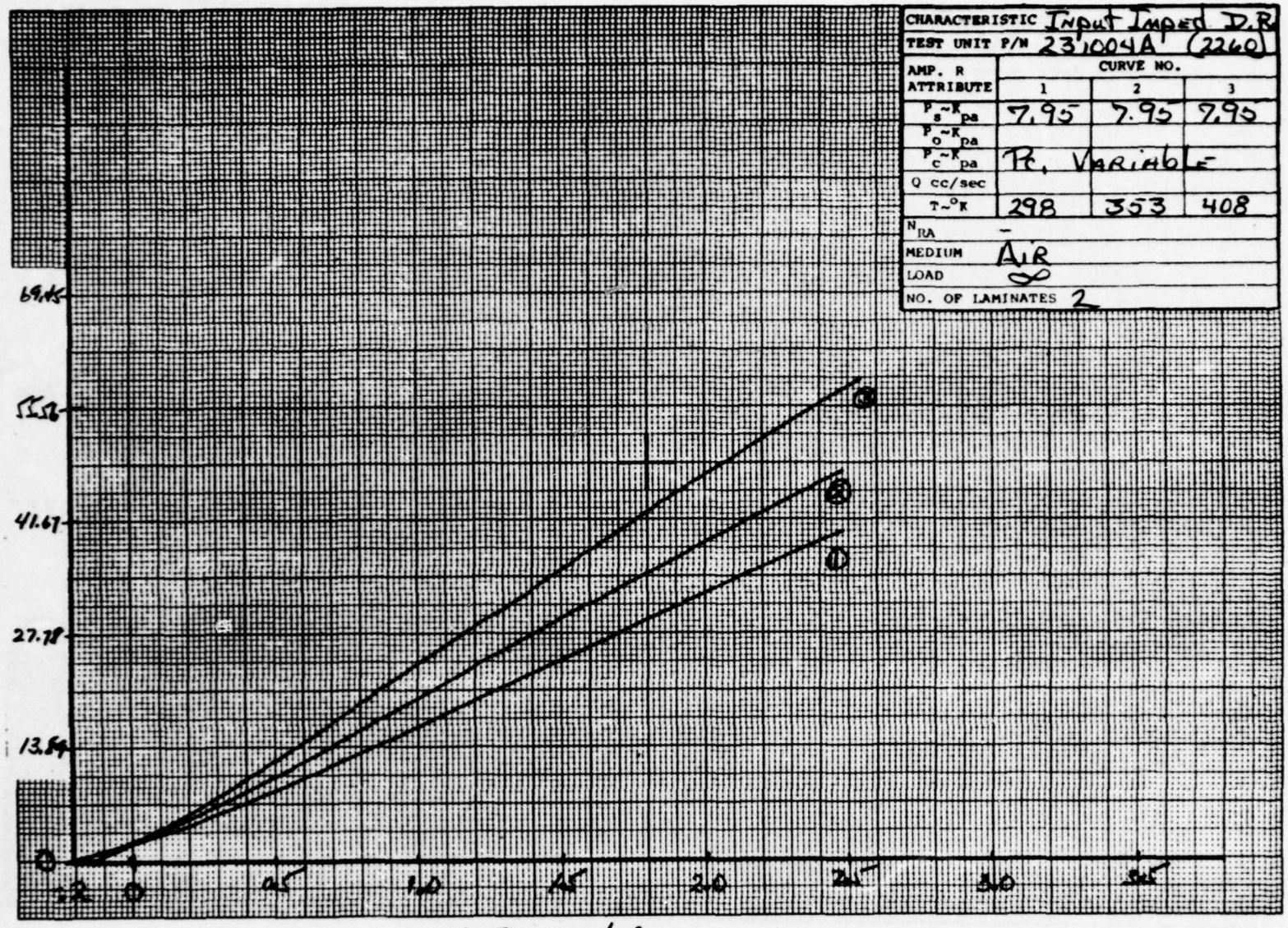

CHARACTERISTIC Def Resis
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~K Pa
1.36
$P_o$ ~K Pa
$P_c$ ~K Pa
$P_c$ VAR. ($P_c$ = 5% $P_s$)
Q cc/sec
T ~°K
298
$N_{RA}$
42.5
MEDIUM
AIR
LOAD
∞
NO. OF LAMINATES 2
0
0
.01
.02
.03
$Q_{c2}$, $m^3$/Sec X $10^7$
$\Delta P_c$, kPa

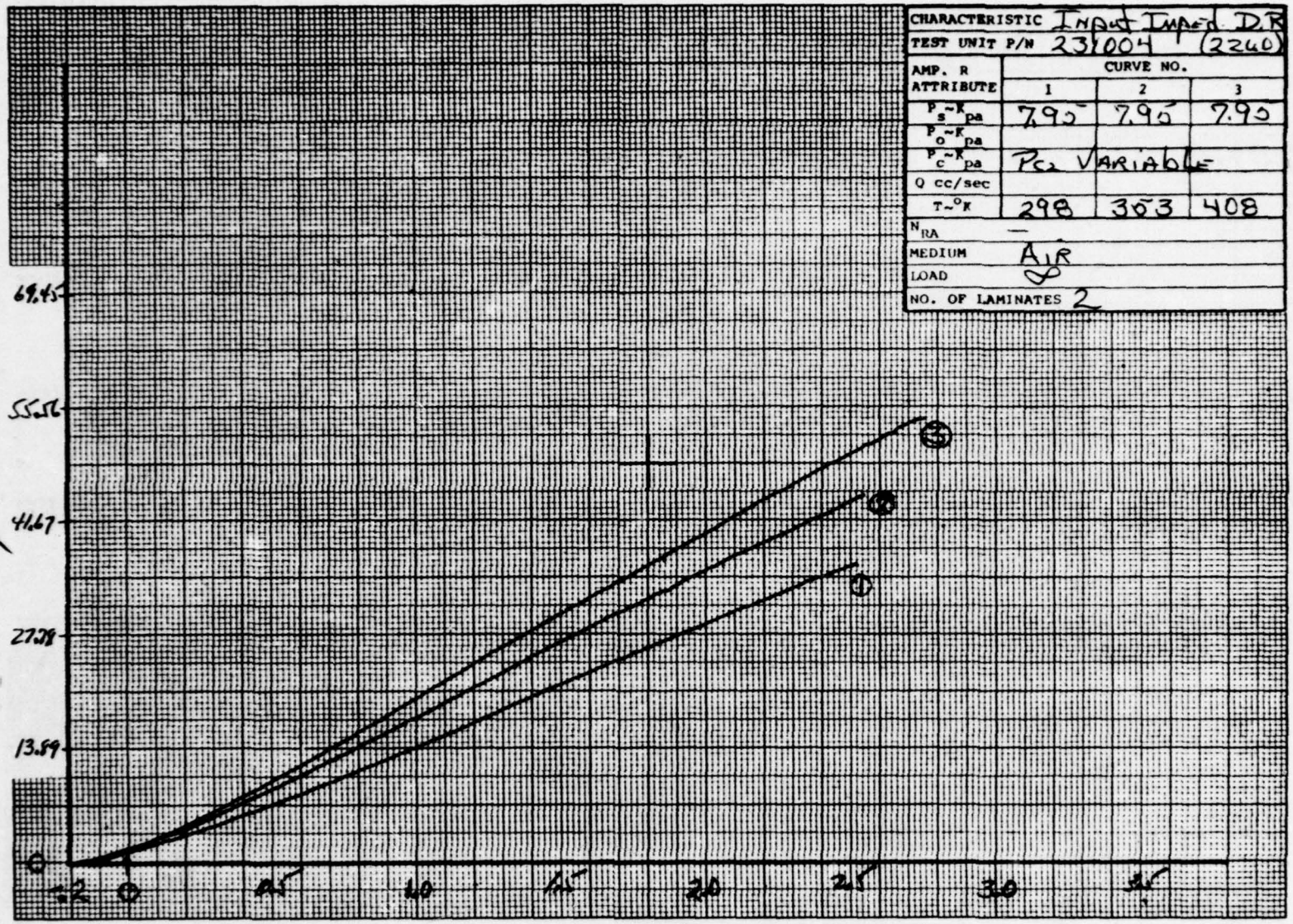

CHARACTERISTIC DEFL. RESIS.
TEST UNIT P/N 23400-4
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
2.0
$P_o$~K pa
$P_c$~K pa
Pc, VAR. (Pc2 = 5%Pc)
Q cc/sec
T~°K
353
$N_{RA}$
42.5
MEDIUM
AIR
LOAD
∞
NO. OF LAMINATES
2
0
0.3
0.6
0.9
1.2
1.5
1.8
$Q_{cl}$, $m^3$/sec X $10^7$
$\Delta P_c$, kPa

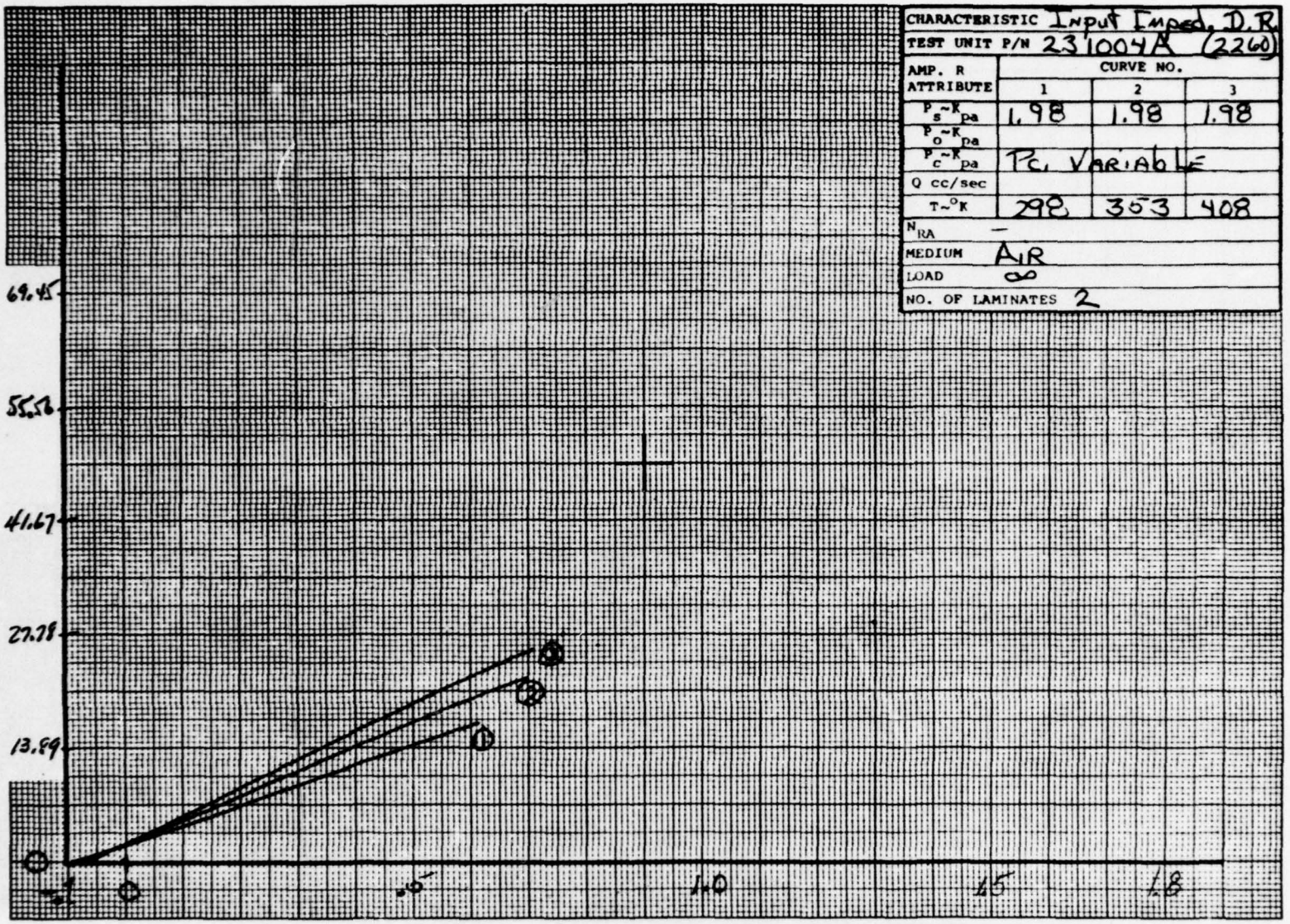

CHARACTERISTIC Def Resis
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
2.0
$P_a$~K pa
$P_c$~K pa
$P_{c_0}$ VAR. ($P_{c_1}$ = 5% $P_s$)
Q cc/sec
T~°K
353
$N_{RA}$
42.5
MEDIUM
AIR
LOAD
∞
NO. OF LAMINATES 2
0
0
0.5
1.0
1.5
2.0
$Q_{c_2}$, $m^3$/sec x $10^7$
$\Delta P_c$, kPa

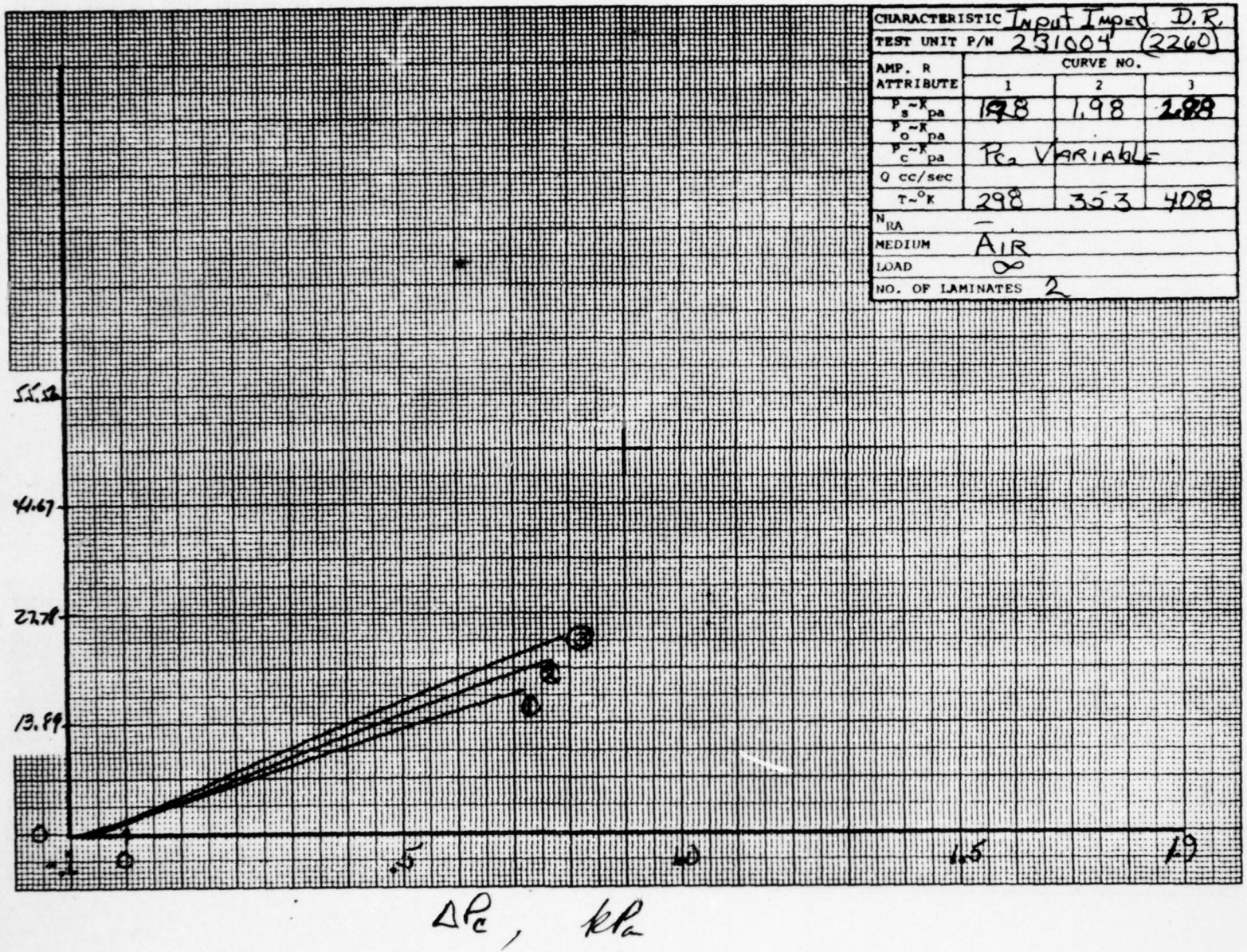

CHARACTERISTIC D
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$-Kpa 2.71
$P_o$-Kpa
$P_c$-Kpa $P_{c_1}$ Var ($P_{c_2}$ = 5% $P_s$)
Q cc/sec
T-°K 408
$N_{RA}$ 42.5
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
$Q_{c_1}$, $m^3$/sec X $10^7$
$\Delta P_c$, kPa
0
0.1
0.2
0.4
0.6
0.8

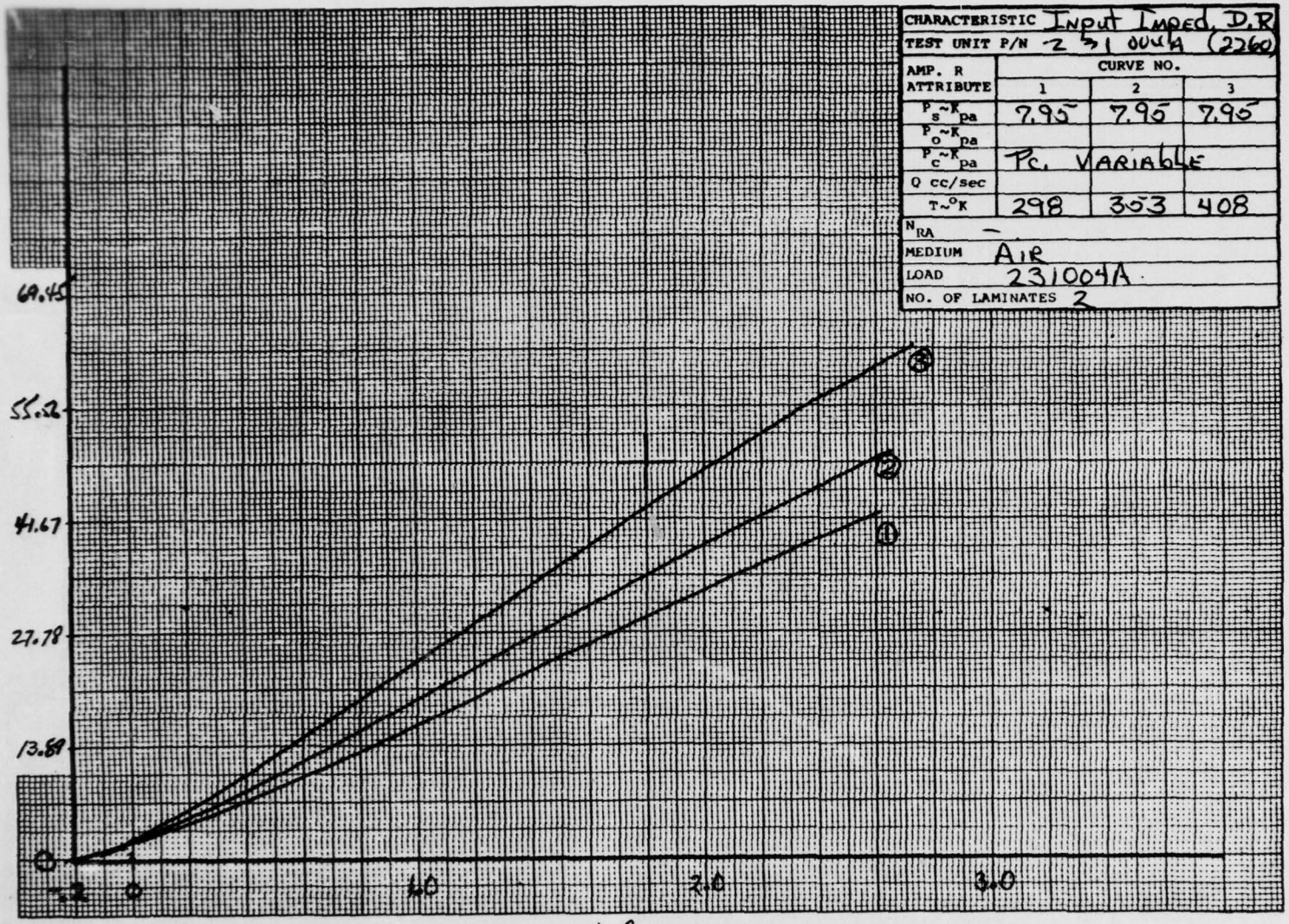

CHARACTERISTIC DATA RUN
TEST UNIT P/N 234004
AMP. R
ATTRIBUTE
CURVE NO.
1
2
3
$P_s \sim K_{pa}$ 2.71
$P_o \sim K_{pa}$
$P_c \sim K_{pa}$ Rs VAR. ($P_s$ = 5% $P_a$)
0 cc/sec
$T \sim °K$ 408
$N_{RA}$ 42.5
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
0
0.2
0.4
0.6
0.8
$Q_{cr}$, $m^3$/sec x $10^4$
$\Delta P_c$, kPa

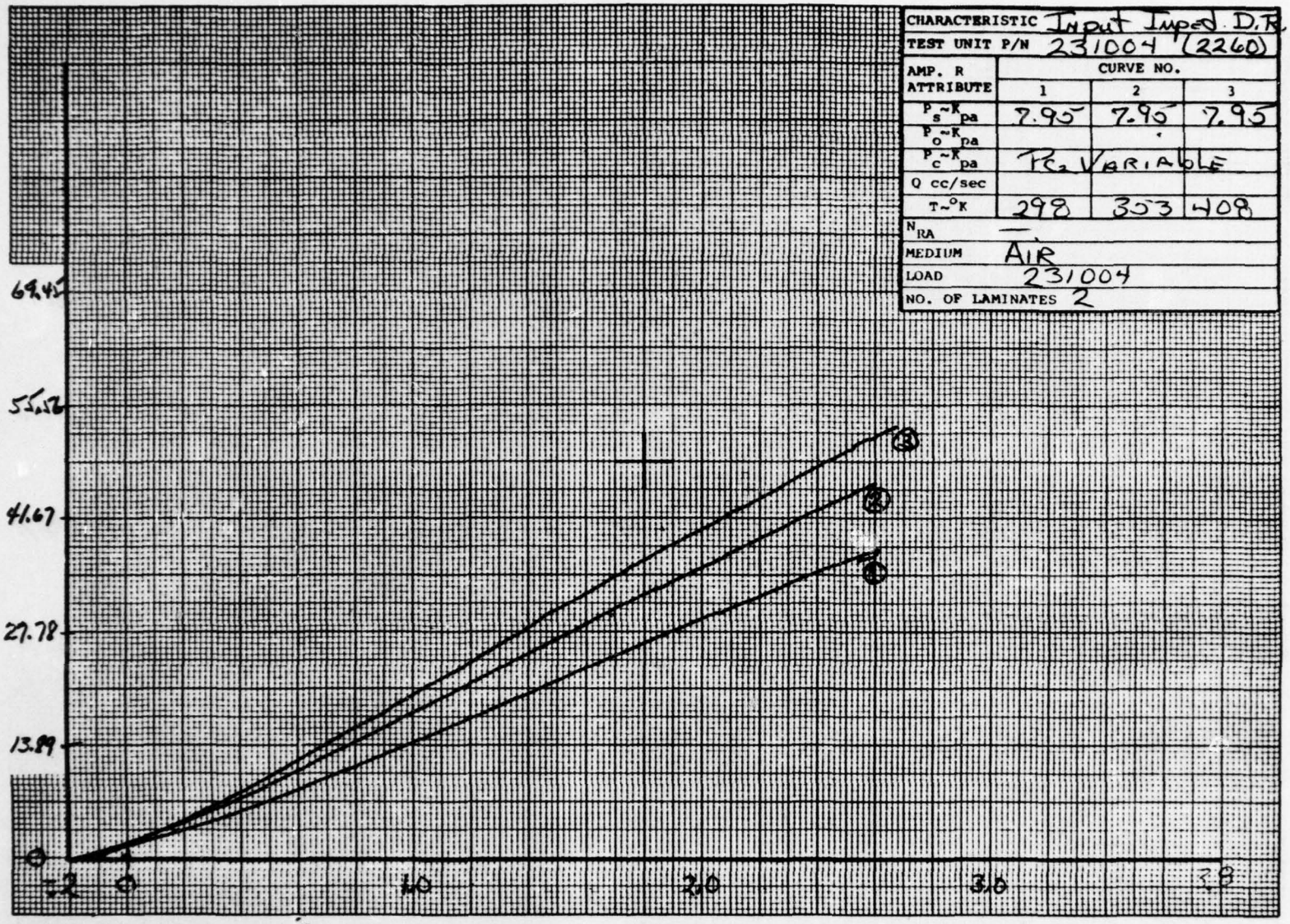

CHARACTERISTIC Input Imped D.R
TEST UNIT P/N 231004A (2260)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~K pa
7.95
7.95
7.95
$P_o$ ~K pa
$P_c$ ~K pa
Pt. Variable
Q cc/sec
T ~°K
298
353
408
$N_{IRA}$ -
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
69.45
55.56
41.67
27.78
13.89
$Q_{21}$, $m^3$/sec X $10^7$
-.2
0
.5
1.0
1.5
2.0
2.5
3.0
3.5
$\Delta P_c$, kPa


CHARACTERISTIC Input Impedance D.R
TEST UNIT P/N 231004 (2240)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~ K pa
7.90
7.90
7.90
$P_o$ ~ K pa
$P_c$ ~ K pa
$P_{c_2}$ VARIABLE
Q cc/sec
T ~ °K
298
353
408
$N_{RA}$ —
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
69.45
55.56
41.67
27.78
13.89
0
-2
0
.5
1.0
1.5
2.0
2.5
3.0
3.5
$Q_{cr}$, m³/sec x 10⁷
ΔPc, kPa

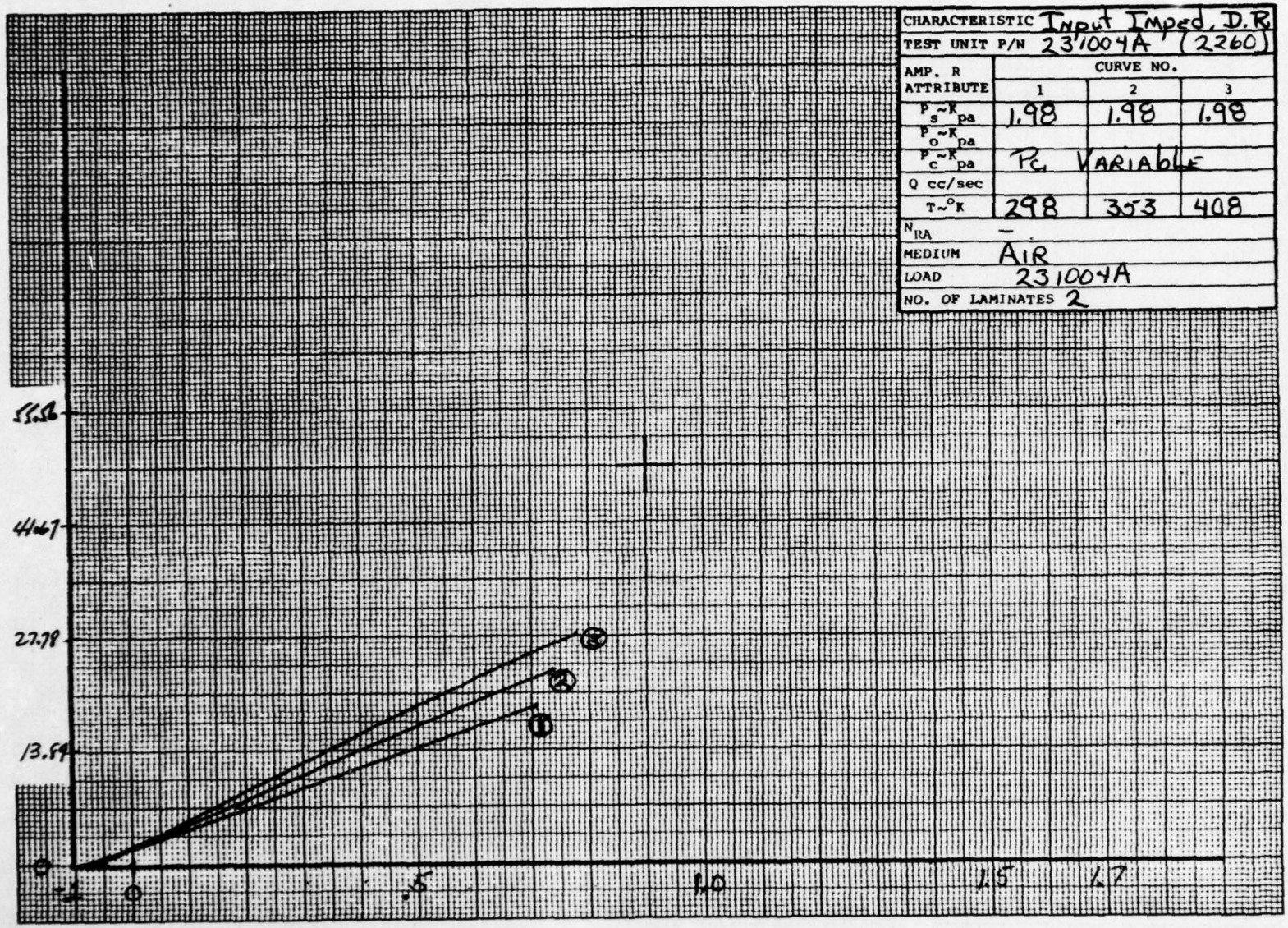

CHARACTERISTIC Input Imped. D.R.
TEST UNIT P/N 231004A (2260)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
1.98
1.98
1.98
$P_o$~K pa
$P_c$~K pa
Pc, VARIABLE
Q cc/sec
T~°K
298
353
408
$N_{RA}$ —
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
69.45
55.56
41.67
27.78
13.89
Qc1, m³/sec X 10⁷
1.0
1.5
1.8
ΔPc, kPa

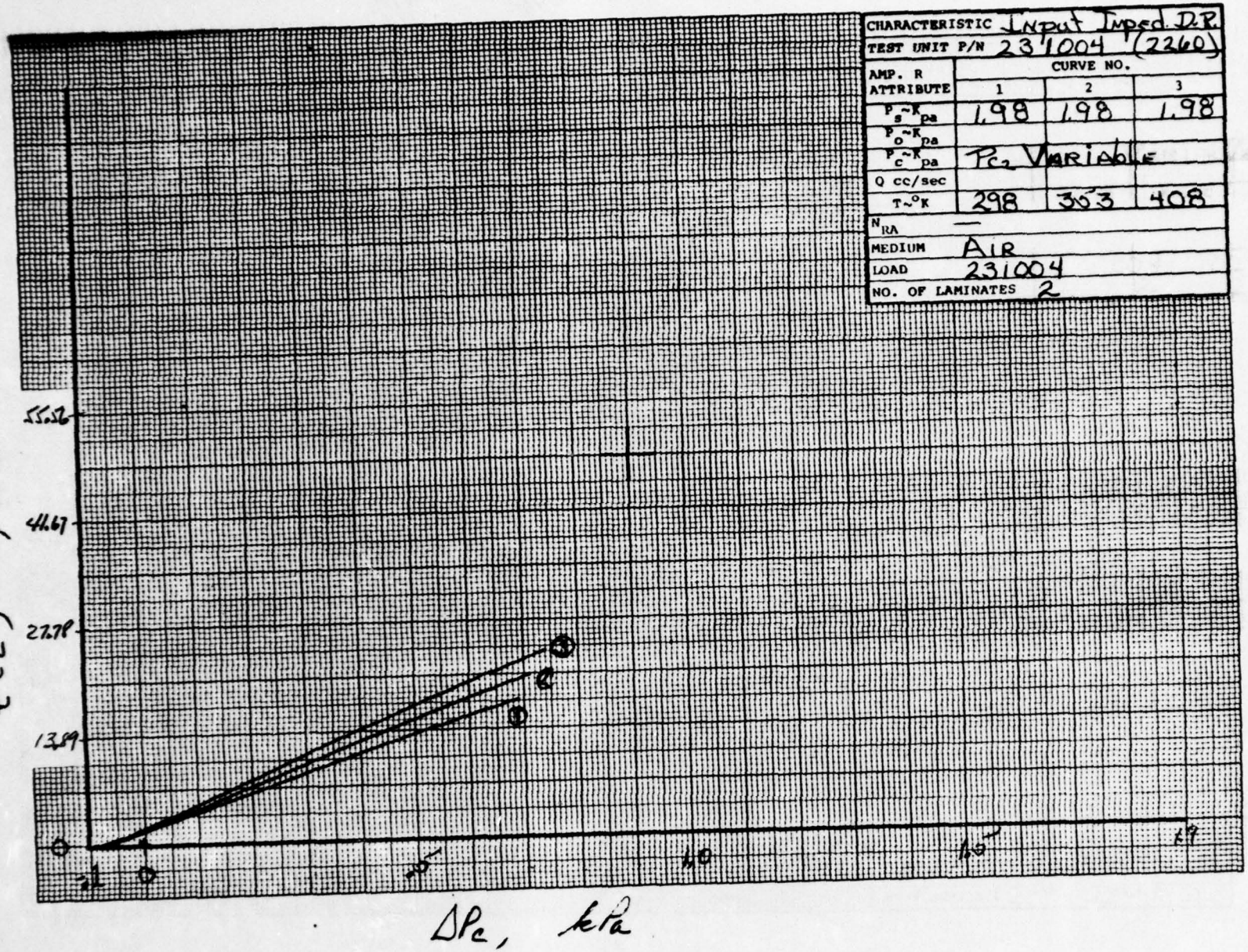

CHARACTERISTIC Input Imped D.R.
TEST UNIT P/N 231004 (2260)
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s \sim K_{pa}$ 1.98 1.98 1.98
$P_o \sim K_{pa}$
$P_c \sim K_{pa}$ Pca VARIABLE
Q cc/sec
$T \sim {}^\circ K$ 298 353 408
$N_{RA}$ —
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
55.56
41.67
27.78
13.89
0
-5
0
+5
10
15
19
$Q_{c2}$, $m^3/sec \times 10^7$
$\Delta P_c$, kPa

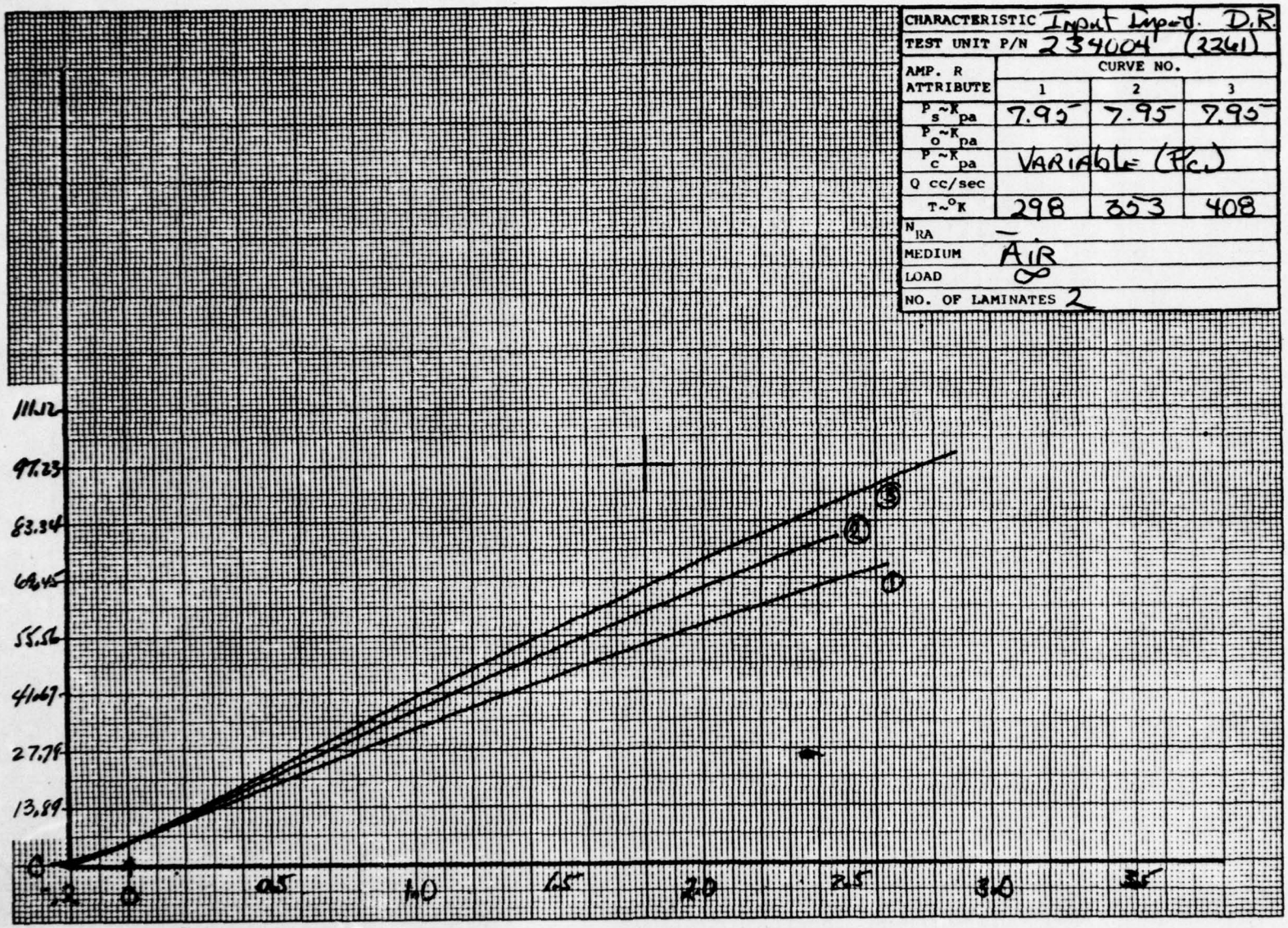

CHARACTERISTIC Input Imped. D.R
TEST UNIT P/N -2 >1 00U4 (2260)
AMP. R ATTRIBUTE
CURVE NO.
1 2 3
$P_s$~Kpa 7.95 7.95 7.95
$P_o$~Kpa
$P_c$~Kpa Pc. VARIABLE
Q cc/sec
T~°K 298 303 408
$N_{RA}$ —
MEDIUM AIR
LOAD 231004A
NO. OF LAMINATES 2
69.45
55.56
41.67
27.78
13.89
0
-.2
0
4.0
2.0
3.0
Qc, m³/sec X 10⁷
Δpc, kPa
①
②
③

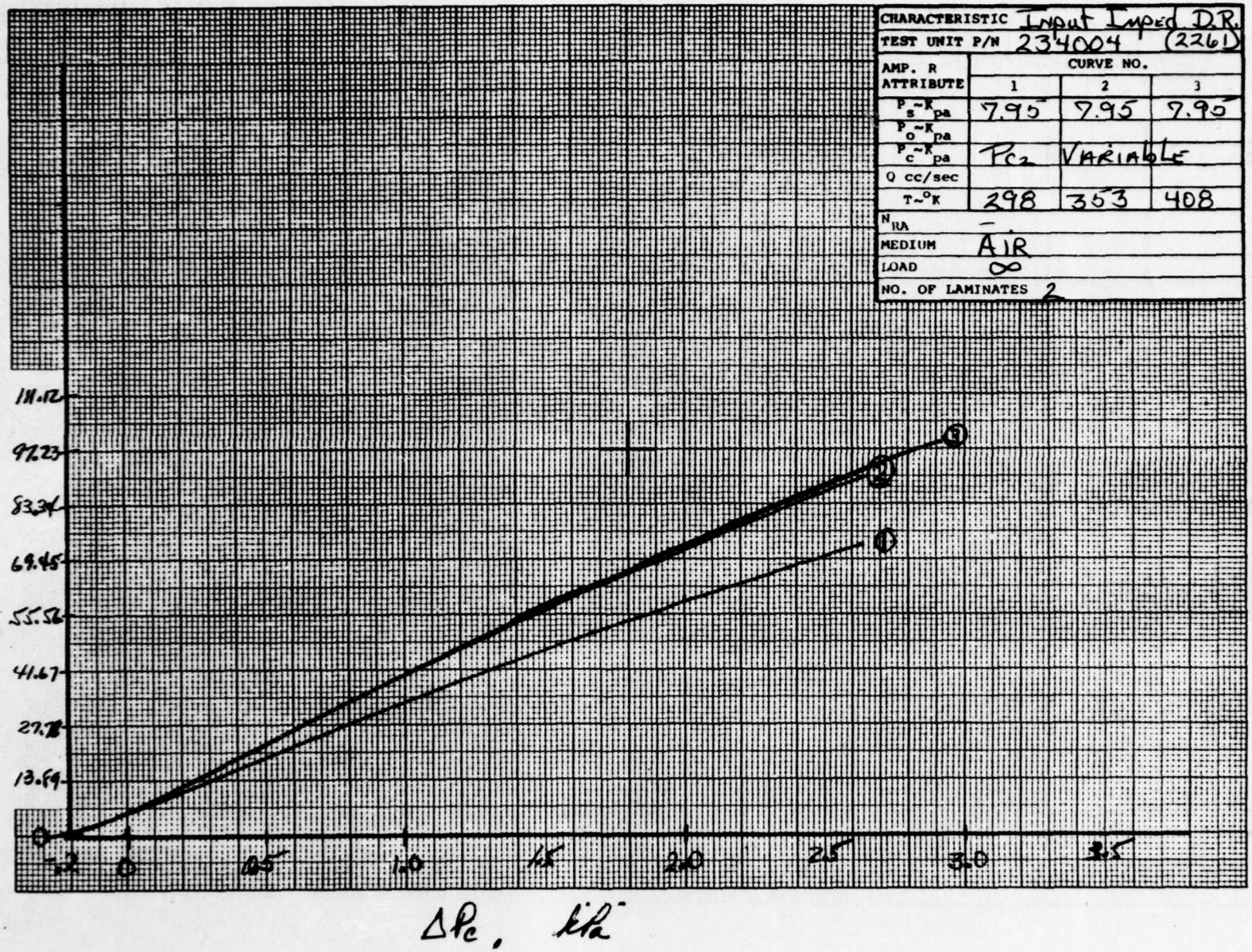

CHARACTERISTIC Input Imped. D.R.
TEST UNIT P/N 231004 (2260)
AMP. R ATTRIBUTE
CURVE NO.
1 2 3
$P_s$ ~Kpa 7.95 7.95 7.95
$P_o$ ~Kpa
$P_c$ ~Kpa Pc, VARIABLE
Q cc/sec
T ~°K 298 303 408
$N_{RA}$
MEDIUM AIR
LOAD 231004
NO. OF LAMINATES 2
69.45
55.56
41.67
27.78
13.89
-.2
0
1.0
2.0
3.0
3.8
$Q_{e2}$, $m^3/sec \times 10^7$
$\Delta P_c$, kPa

370

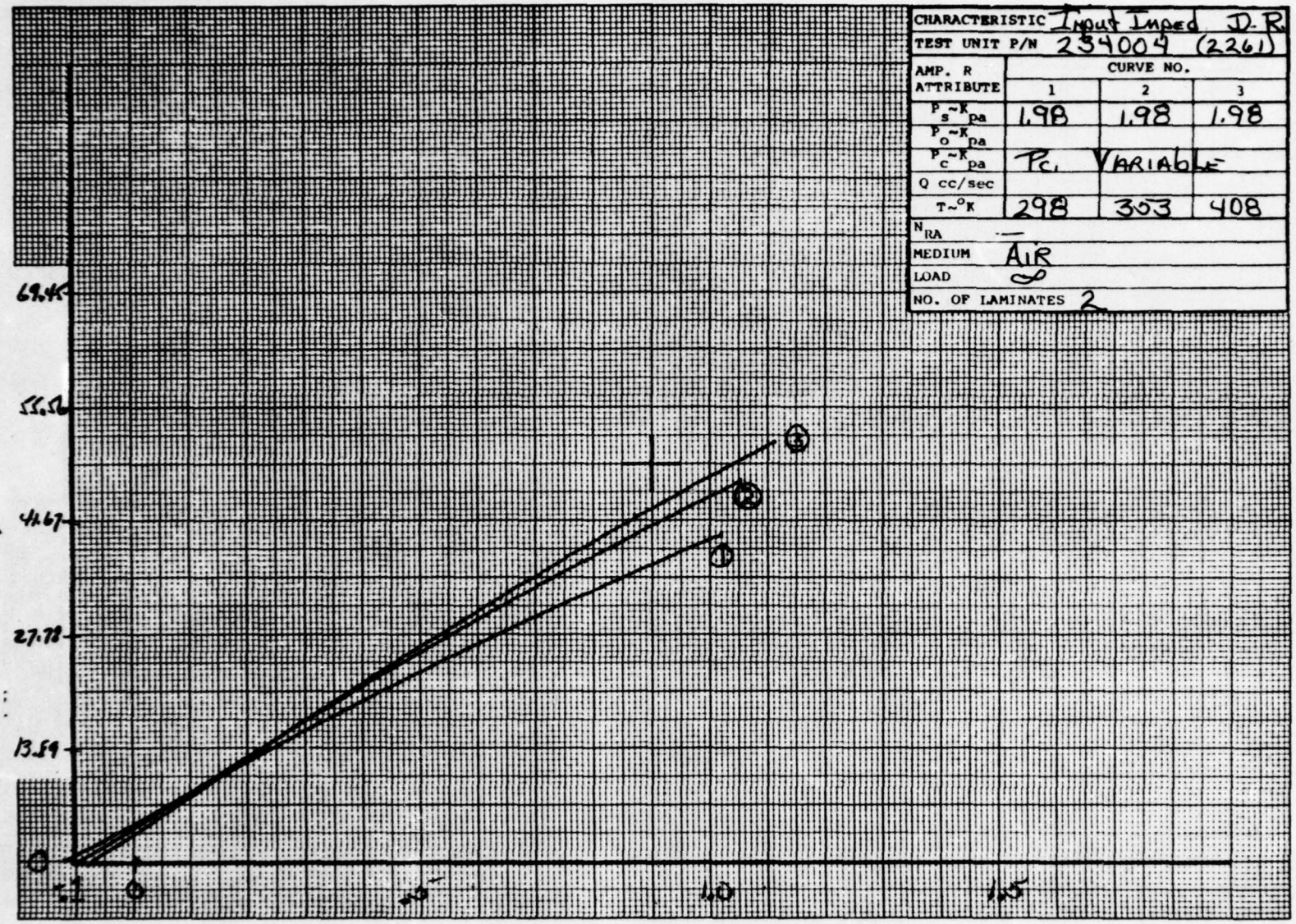

CHARACTERISTIC Input Imped, D.R
TEST UNIT P/N 231004A (2260)
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~Kpa 1.98 1.98 1.98
$P_o$~Kpa
$P_c$~Kpa Pc VARIABLE
Q cc/sec
T~°K 298 353 408
$N_{RA}$ –
MEDIUM AIR
LOAD 231004A
NO. OF LAMINATES 2
55.56
44.67
27.78
13.54
-.1
0
.5
1.0
1.5
1.7
ΔPc, m³/sec x 10⁷
ΔPc, kPa

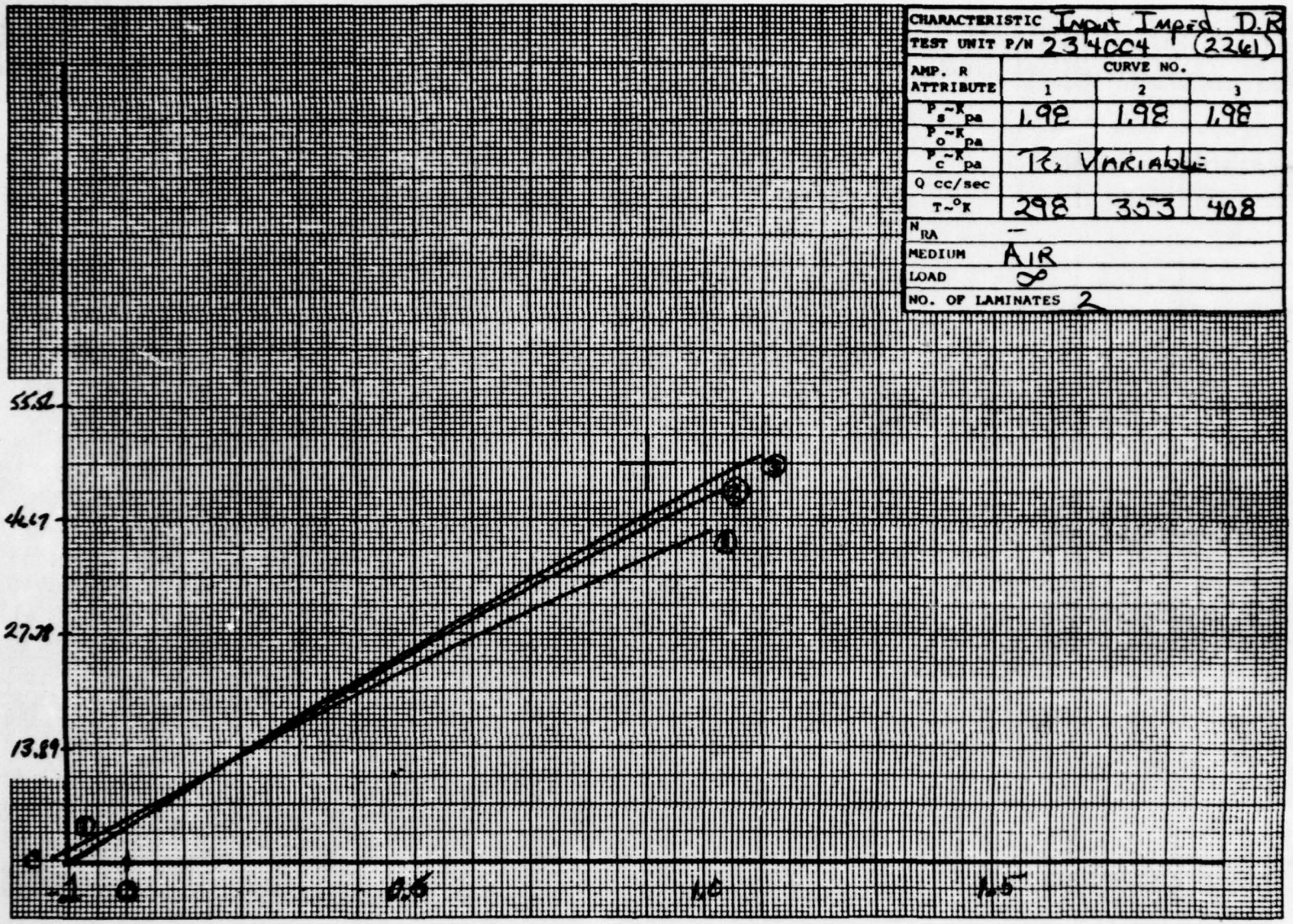

CHARACTERISTIC Input Imped. D.R.
TEST UNIT P/N 231004 (2360)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~K pa
1.98
1.98
1.98
$P_o$ ~K pa
$P_c$ ~K pa
$P_{c_2}$ Variable
Q cc/sec
T ~°K
298
303
408
$N_{RA}$ —
MEDIUM Air
LOAD 231004
NO. OF LAMINATES 2
55.56
41.67
27.78
13.89
0
$Q_{c_2}$, $m^3/sec \times 10^7$
$\Delta P_c$, kPa

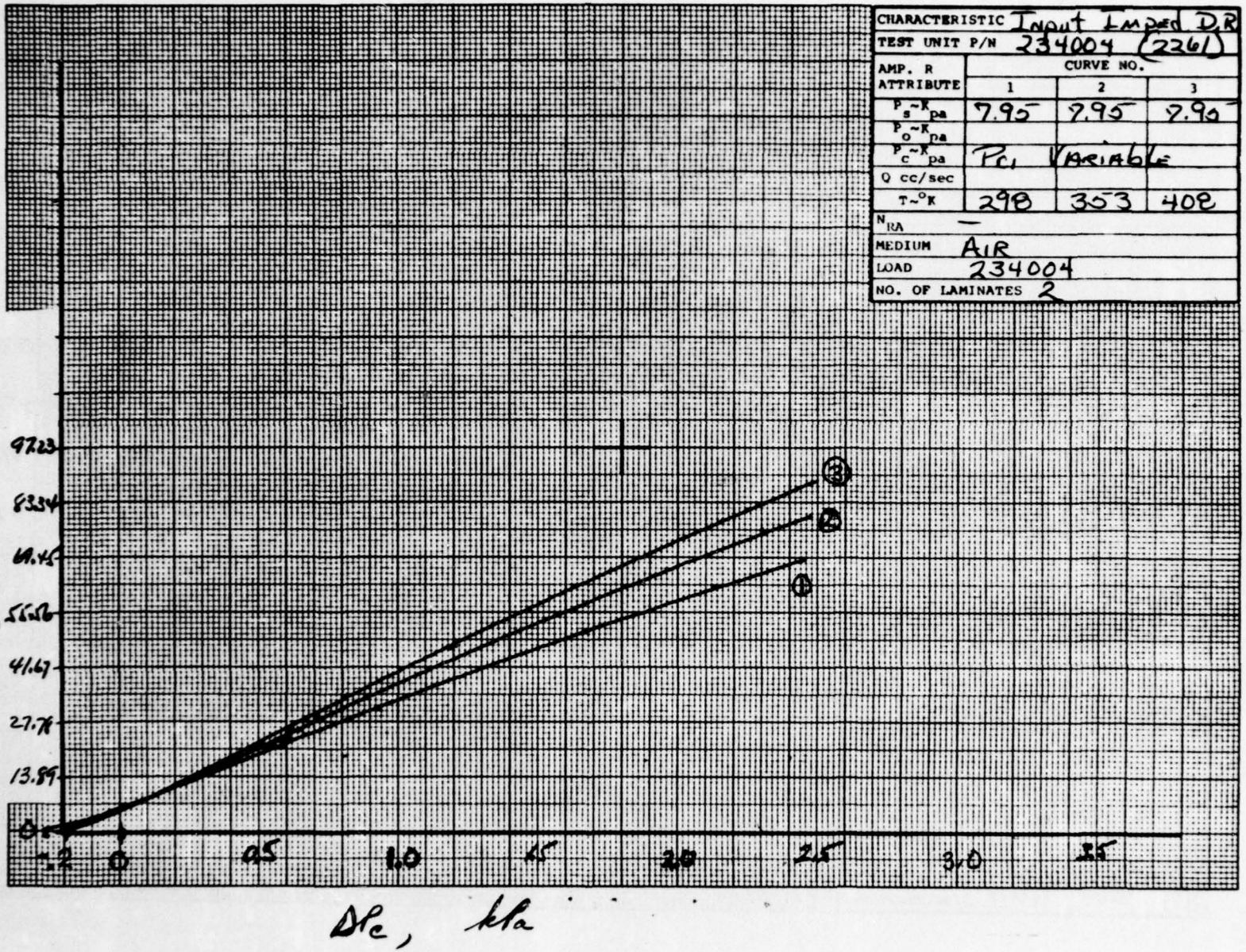

CHARACTERISTIC Input Imped. D.R.
TEST UNIT P/N 234004 (3261)
AMP. R ATTRIBUTE
CURVE NO.
1 2 3
$P_s$~Kpa 7.95 7.95 7.95
$P_o$~Kpa
$P_c$~Kpa VARIABLE ($P_{C_1}$)
Q cc/sec
T~°K 298 353 408
$N_{RA}$ ∞
MEDIUM AIR
LOAD
NO. OF LAMINATES 2
111.12
97.23
83.34
69.45
55.56
41.67
27.78
13.89
0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
$Q_{C_1}$, $m^3/sec \times 10^{-7}$
$\Delta P_C$, kPa

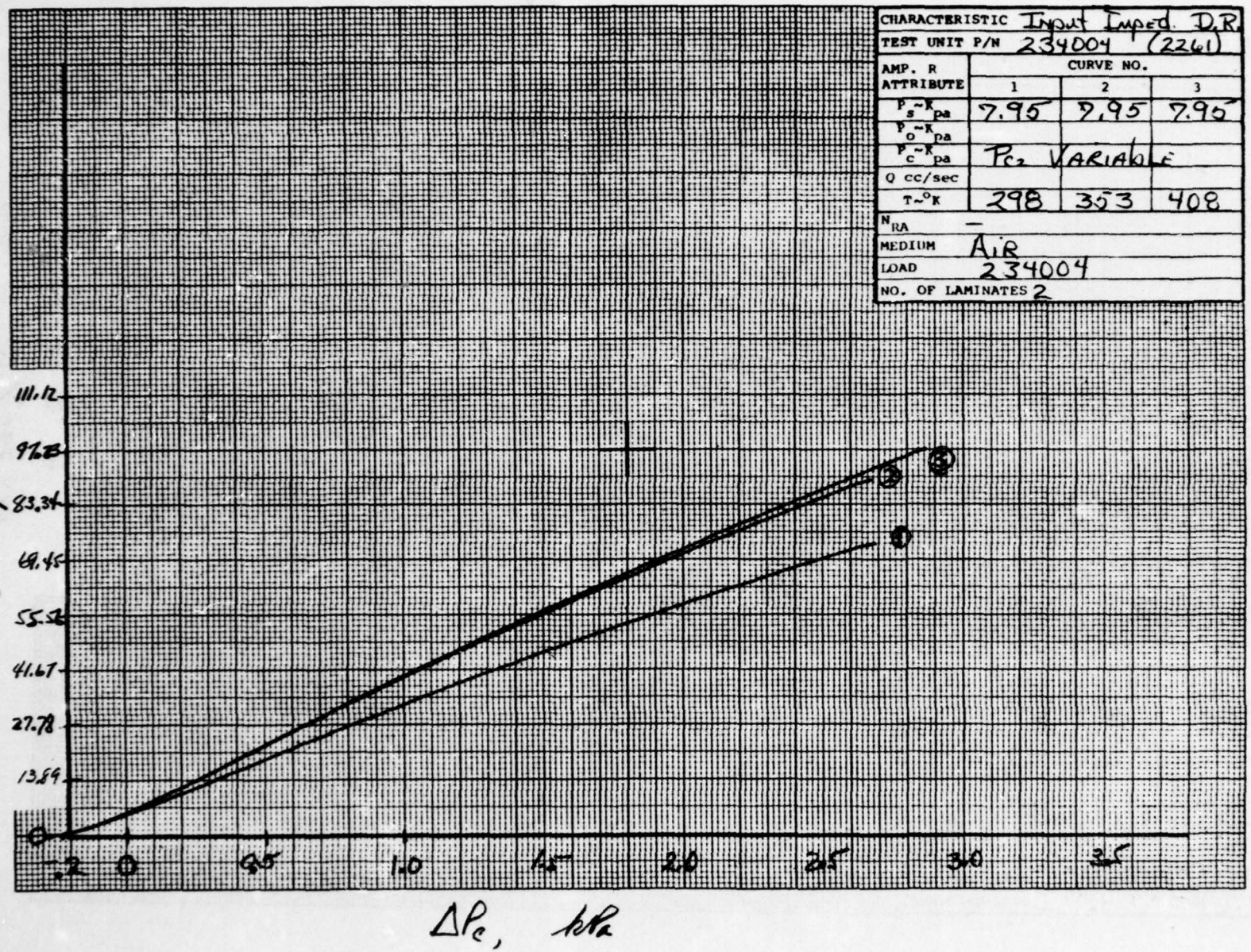

CHARACTERISTIC Input Imped D.R.
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa 7.95 7.95 7.95
$P_o$~Kpa
$P_c$~Kpa $P_{c_2}$ VARIABLE
Q cc/sec
T~°K 298 353 408
$N_{IRA}$ —
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
$Q_{c_2}$, $in^3/sec \times 10^2$
111.12
97.23
83.34
69.45
55.56
41.67
27.78
13.89
0
-.2
0
.5
1.0
1.5
2.0
2.5
3.0
3.5
$\Delta P_c$, psi

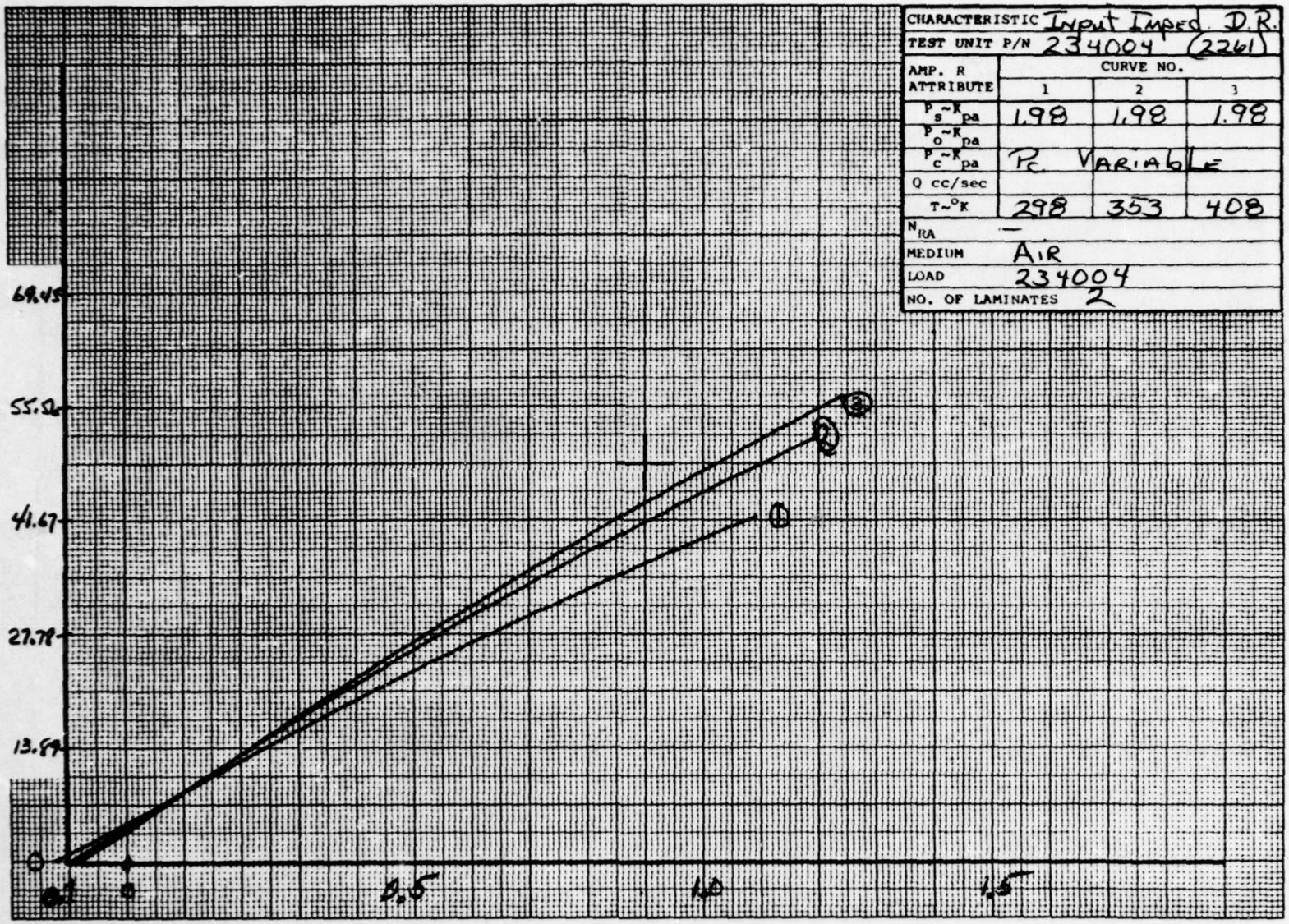
374

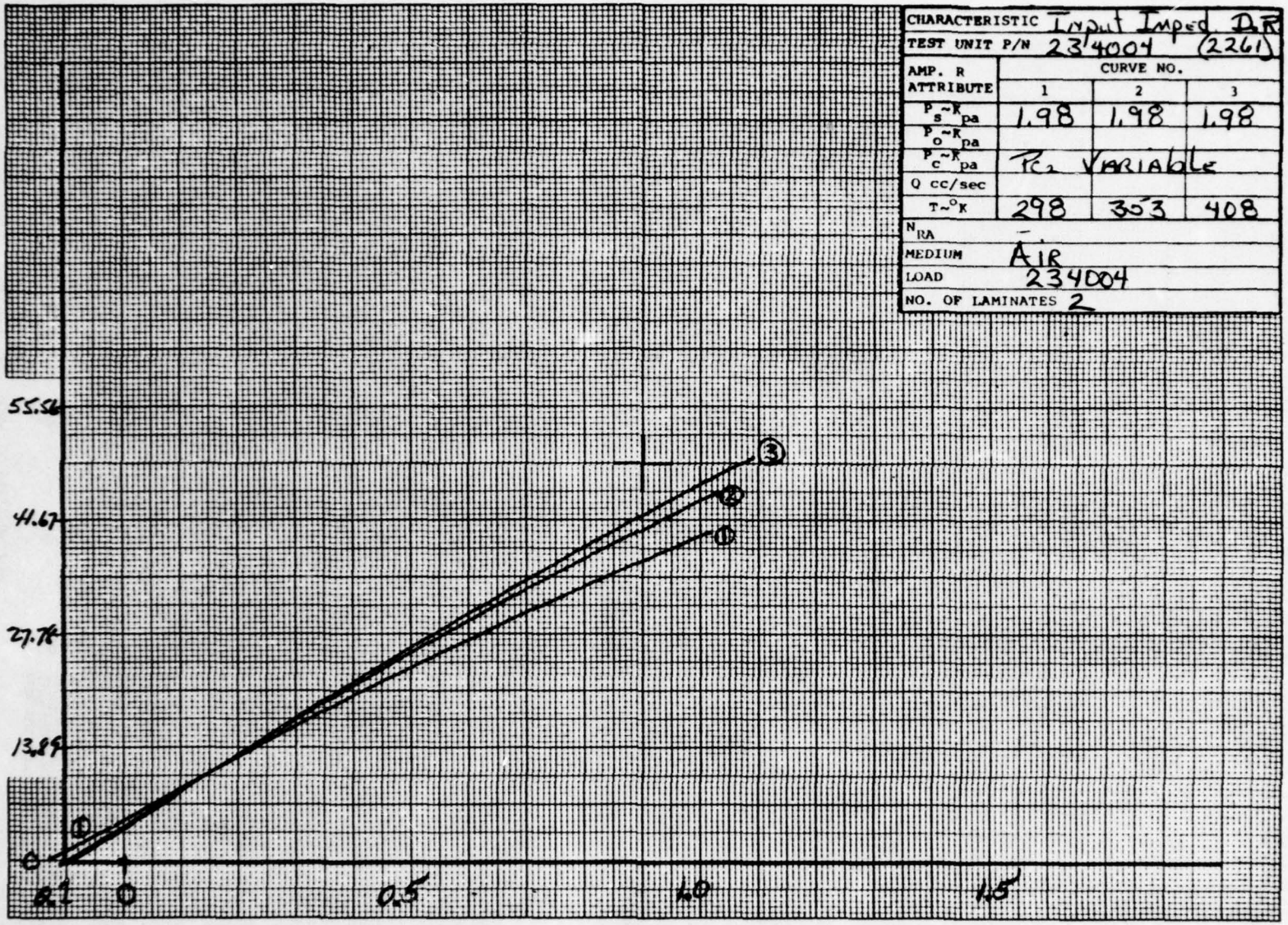

CHARACTERISTIC Input Imped D.R.
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa 1.98 1.98 1.98
$P_o$~K pa
$P_c$~K pa Pc, VARIABLE
Q cc/sec
T~°K 298 303 408
$N_{RA}$ —
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
69.45
55.56
41.67
27.78
13.89
0
.5
1.0
1.5
ΔPc, kPa
Pc1, m³/sec x 10⁷

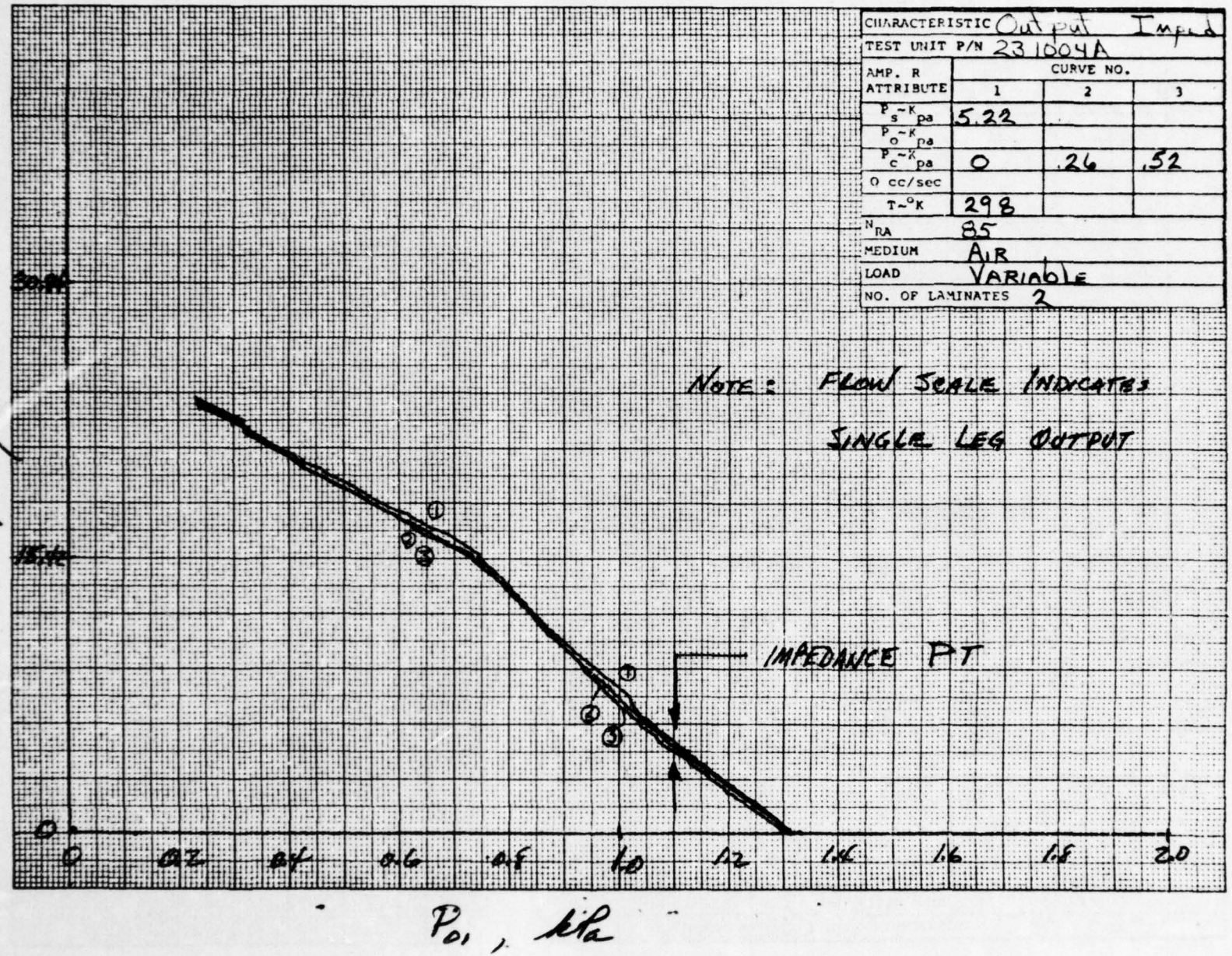

CHARACTERISTIC Input Imped. D.R
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~K pa
1.98
1.98
1.98
$P_o$ ~K pa
$P_c$ ~K pa
Re VARIABLE
Q cc/sec
T ~°K
298
353
408
$N_{RA}$ —
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
55.52
41.64
27.76
13.89
0.5
1.0
1.5
$Q_{e2}$, $m^3$/sec x $10^7$
$\Delta P_e$, kPa

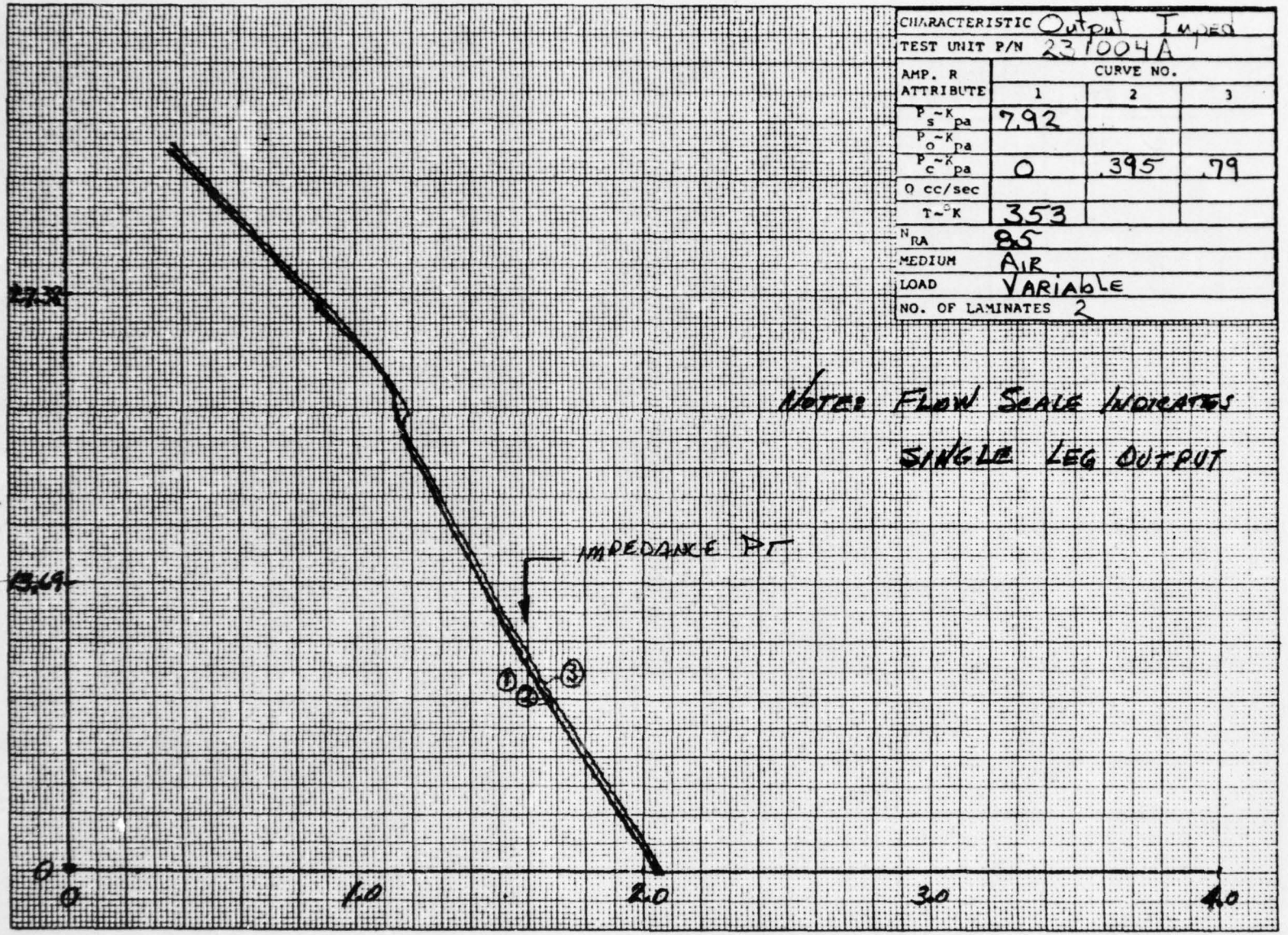

CHARACTERISTIC Input Imped D.R
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa 7.95 7.95 7.90
$P_o$~Kpa
$P_c$~Kpa Pc1 VARIABLE
Q cc/sec
T~°K 298 353 408
$N_{RA}$ —
MEDIUM AIR
LOAD 234004
NO. OF LAMINATES 2
Qc1, m³/sec x10⁷
97.23
83.34
69.45
55.56
41.67
27.78
13.89
0
-.2
0
.5
1.0
1.5
2.0
2.5
3.0
3.5
Pc, kPa
377


CHARACTERISTIC Input Imped. D.R.
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~$K_{pa}$ 7.95 7.95 7.95
$P_o$~$K_{pa}$
$P_c$~$K_{pa}$ $P_{c_2}$ VARIABLE
Q cc/sec
T~°K 298 353 408
$N_{RA}$ —
MEDIUM AIR
LOAD 234004
NO. OF LAMINATES 2
$Q_{c_2}$, $m^3/sec \times 10^7$
111.12
97.23
83.34
69.45
55.56
41.67
27.78
13.89
0
-.2
0
.5
1.0
1.5
2.0
2.5
3.0
3.5
$\Delta P_c$, kPa


CHARACTERISTIC Input Imped. D.R.
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO.
1 2 3
$P_s$~K pa 1.98 1.98 1.98
$P_o$~K pa
$P_c$~K pa Pc VARIABLE
Q cc/sec
T~°K 298 353 408
$N_{RA}$ —
MEDIUM AIR
LOAD 234004
NO. OF LAMINATES 2
69.45
55.56
41.67
27.78
13.89
0
0.5
1.0
1.5
$Q_{c1}$, $m^3/sec \times 10^7$
$\Delta P_c$, kPa

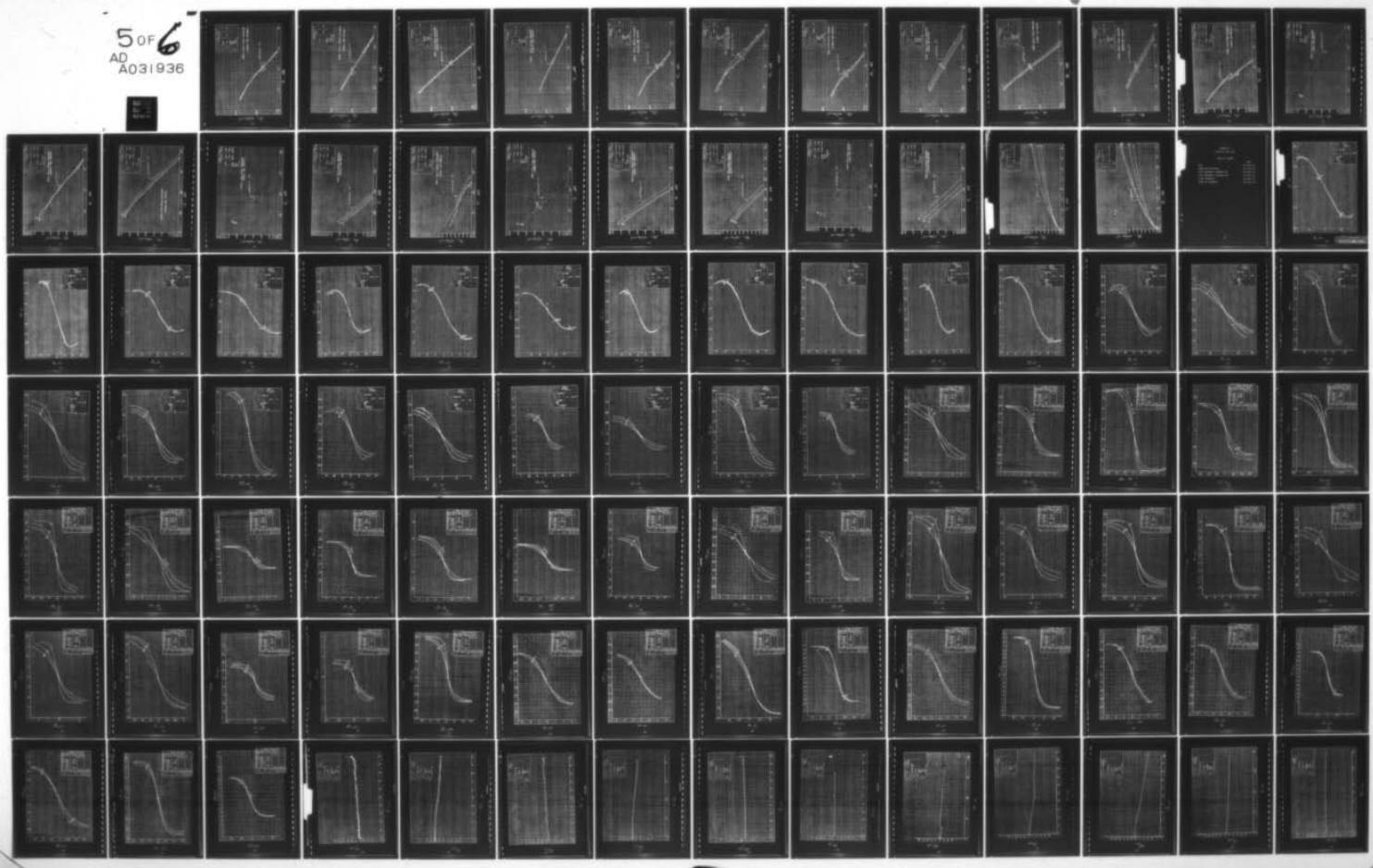

CHARACTERISTIC Input Imped. DR
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~K pa 1.98 1.98 1.98
$P_o$ ~K pa
$P_c$ ~K pa $P_{c_2}$ VARIABLE
Q cc/sec
T ~°K 298 303 408
$N_{RA}$
MEDIUM AIR
LOAD 234004
NO. OF LAMINATES 2
$Q_{c_2}$, $m^3/sec \times 10^7$
55.56
41.67
27.78
13.89
0
-0.1
0
0.5
1.0
1.5
$\Delta P_c$, kPa
380


CHARACTERISTIC Output Impd
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$-Kpa 5.22
$P_o$-Kpa
$P_c$-Kpa 0 .26 .52
Q cc/sec
T-°K 298
$N_{RA}$ 85
MEDIUM AIR
LOAD VARIABLE
NO. OF LAMINATES 2
NOTE: FLOW SCALE INDICATES SINGLE LEG OUTPUT
IMPEDANCE PT
$Q_{01}$, $m^3$/sec x $10^7$
$P_{01}$, kPa
0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0


CHARACTERISTIC Output Impedance
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa 7.93
$P_o$~K pa
$P_c$~K pa 0 .395 .79
0 cc/sec
T~°K 353
$N_{RA}$ 85
MEDIUM AIR
LOAD VARIABLE
NO. OF LAMINATES 2
Notes: Flow Scale Indicates Single Leg Output
IMPEDANCE PT
$Q_{01}$, $m^3/sec \times 10^3$
$P_{01}$, kPa
0
1.0
2.0
3.0
4.0

AD-A031 936 AIRESEARCH MFG CO OF ARIZONA PHOENIX F/G 20/4
ENVIRONMENTAL TEST PROGRAM FOR EVALUATION OF FLUIDIC ELEMENTS F--ETC(U)
DEC 75 M F CYCON, T G SUTTON, H R GAMBLE DAAG39-74-C-0187
UNCLASSIFIED 75-411145 HDL-CR-75-187-1 NL

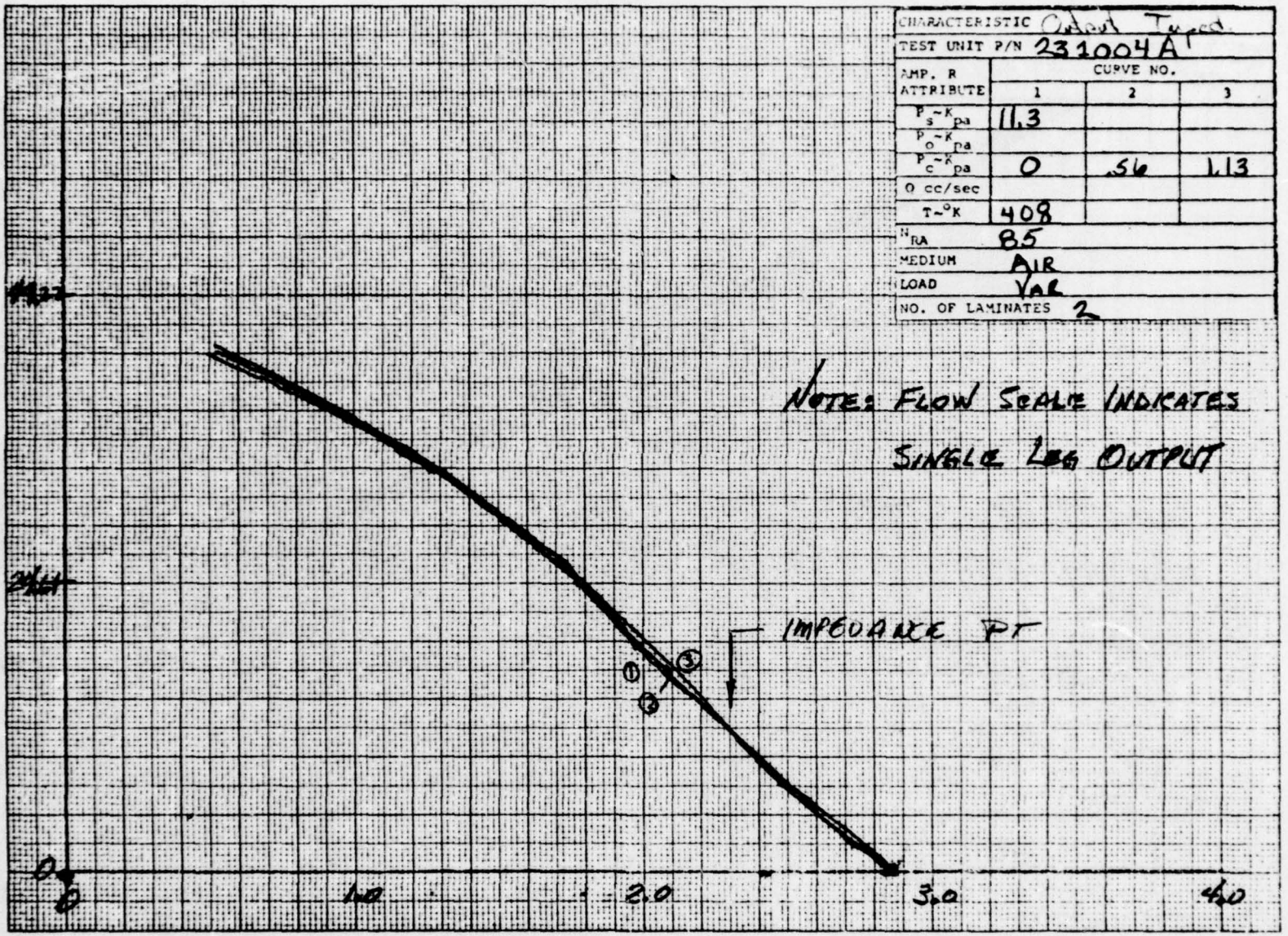
5 OF 6
AD A031936

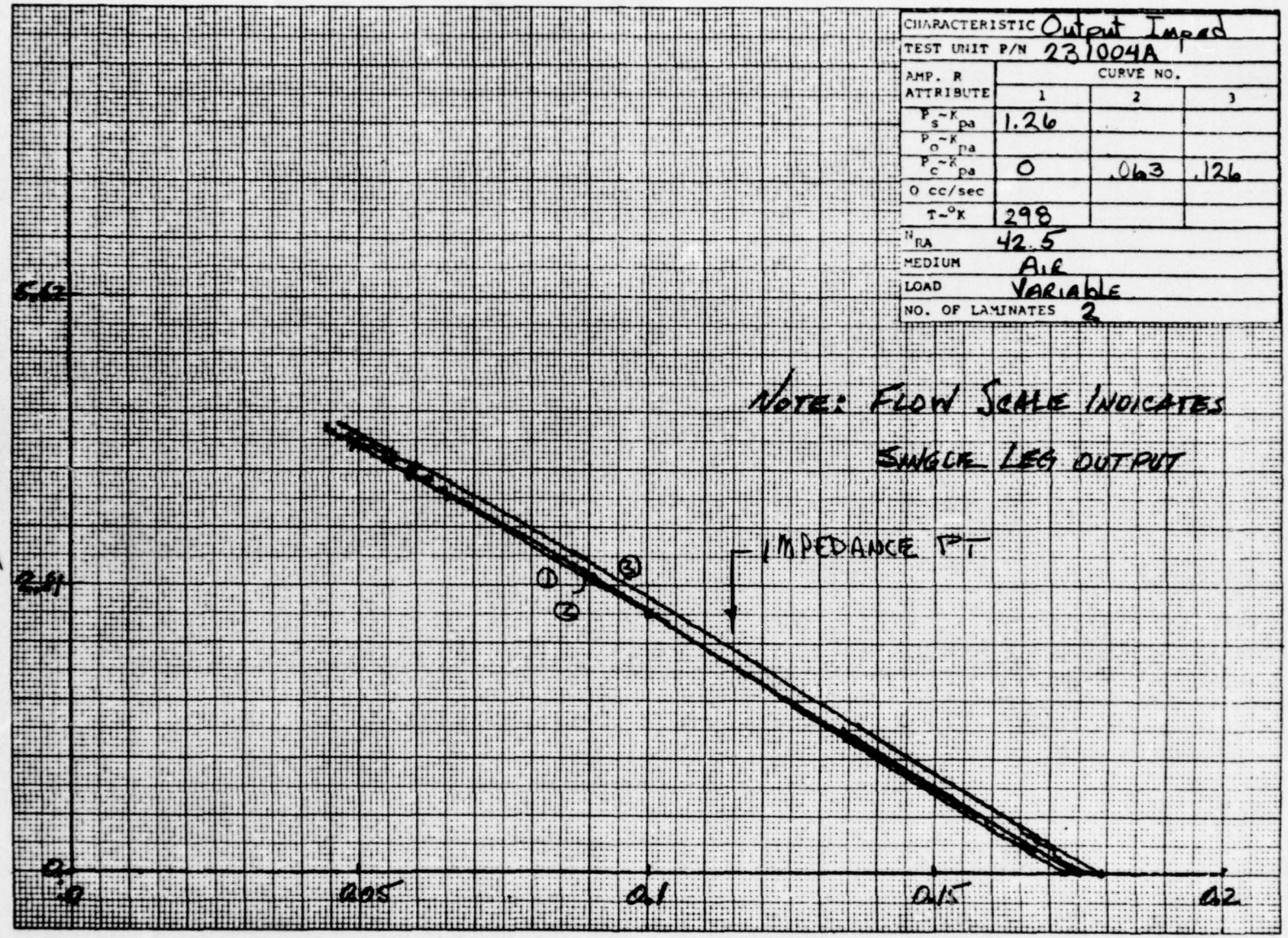


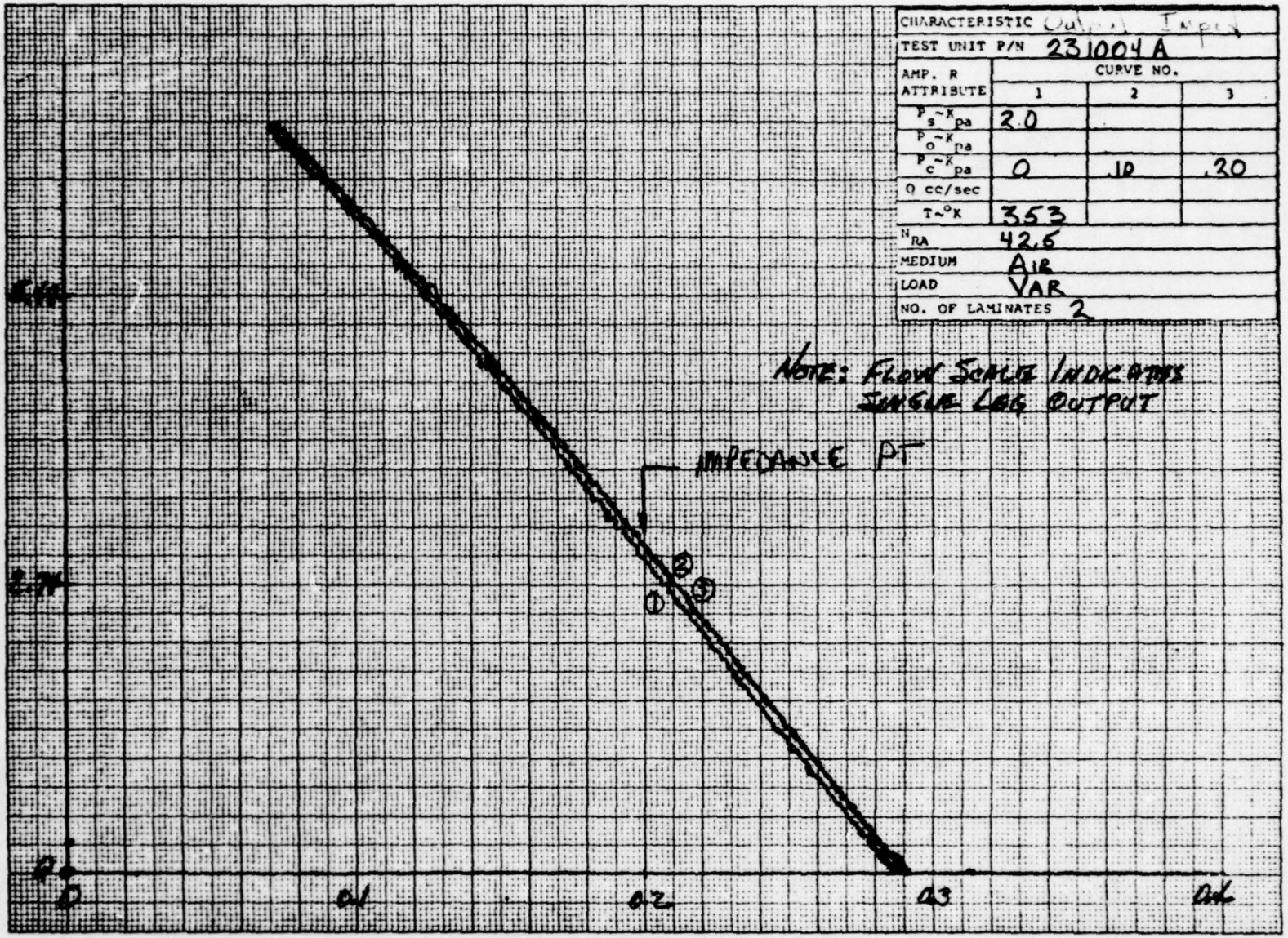
5 OF 6

AD A031936

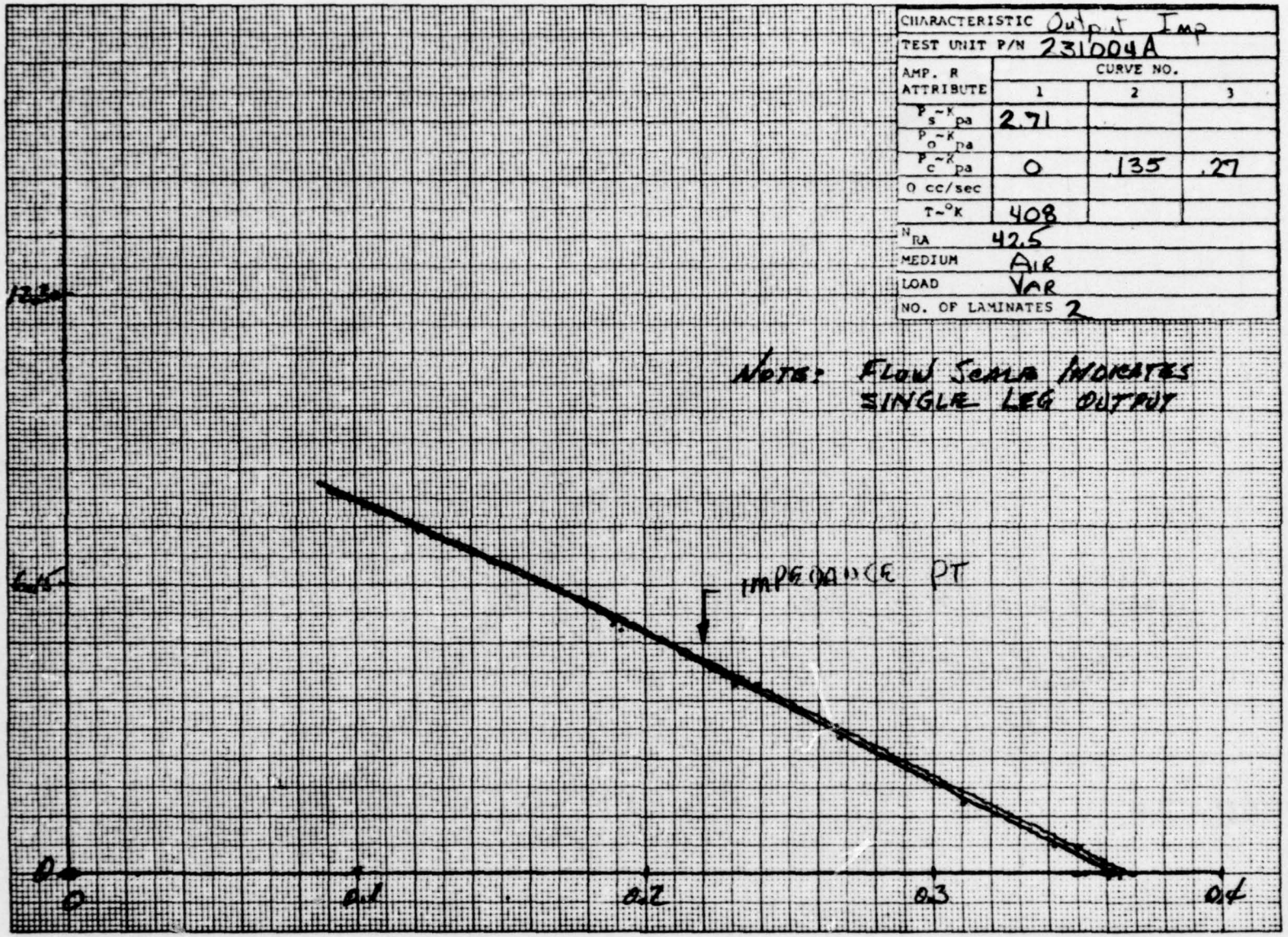



CHARACTERISTIC Orbit Typed
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
11.3
$P_o$~K pa
$P_c$~K pa
0
.56
1.13
0 cc/sec
T~°K
408
$N_{RA}$
85
MEDIUM
AIR
LOAD
VAC
NO. OF LAMINATES
2
NOTE: FLOW SCALE INDICATES
SINGLE LOG OUTPUT
IMPEDANCE PT
1.0
2.0
3.0
4.0
$Q_{01}$, $m^3/sec \times 10^7$
$P_{01}$, kPa


CHARACTERISTIC Output Imped
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~ K pa
1.26
$P_o$ ~ K pa
$P_c$ ~ K pa
0
.063
.126
Q cc/sec
T ~ °K
298
$N_{RA}$
42.5
MEDIUM
Air
LOAD
Variable
NO. OF LAMINATES
2
NOTE: FLOW SCALE INDICATES
SINGLE LEG OUTPUT
IMPEDANCE PT
0.2
0.1
0.05
0
$Q_{01}$, $m^3/sec \times 10^2$
$P_{01}$, kPa


CHARACTERISTIC Output Impedance
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa 2.0
$P_o$~K pa
$P_c$~K pa 0 .10 .30
Q cc/sec
T~°K 353
$N_{RA}$ 42.6
MEDIUM AIR
LOAD VAR
NO. OF LAMINATES 2
NOTE: FLOW SCALE INDICATES SINGLE LOG OUTPUT
IMPEDANCE PT
$Q_{01}$, $m^3$/sec x $10^4$
$P_{01}$, kPa
0
.1
.2
.3
.4

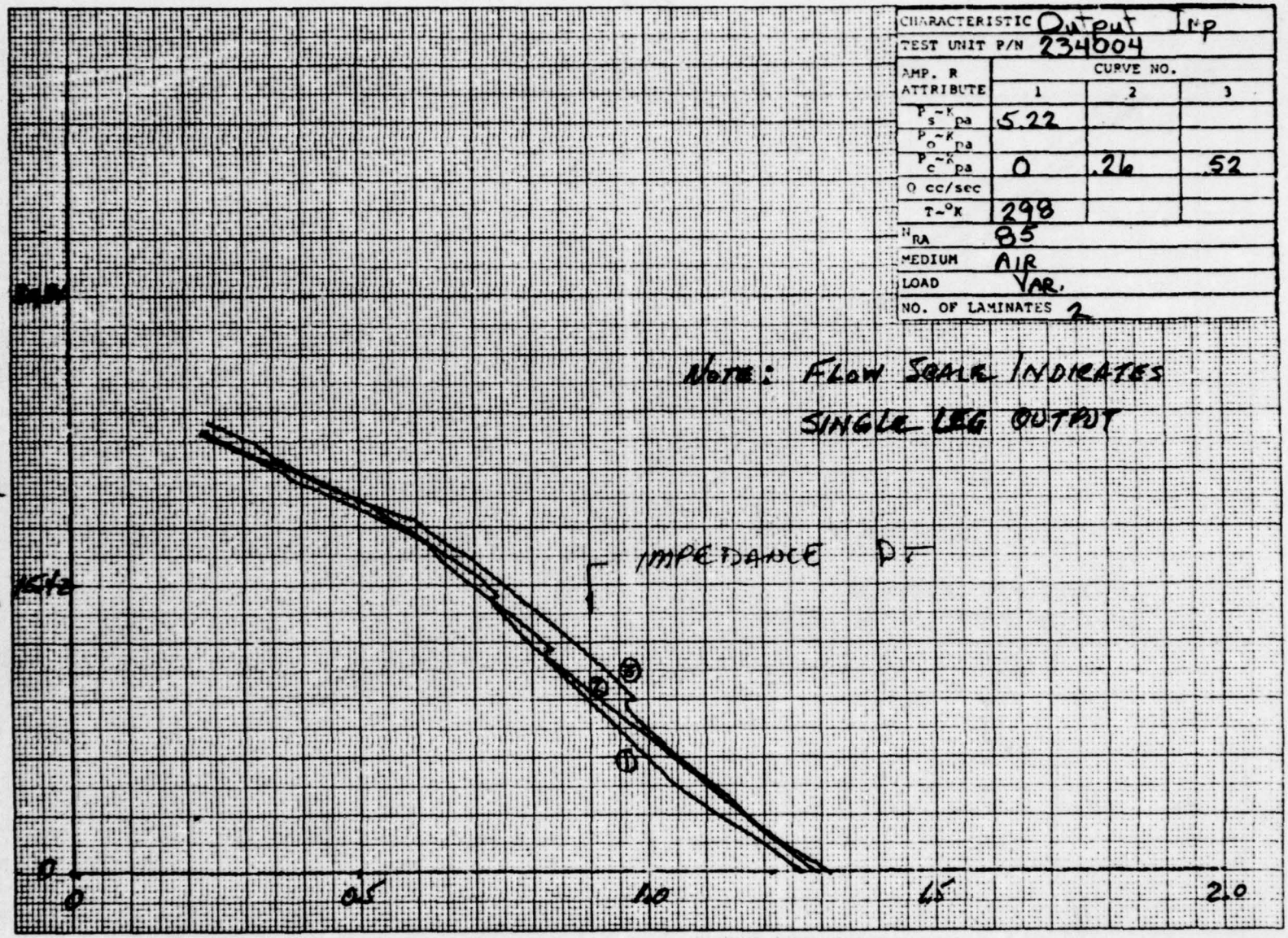
| CHARACTERISTIC | Output Imp | | |
|---|---|---|---|
| TEST UNIT P/N | 231004A | | |
| AMP. R ATTRIBUTE | CURVE NO. 1 | 2 | 3 |
| $P_s$ ~ K pa | 2.71 | | |
| $P_o$ ~ K pa | | | |
| $P_c$ ~ K pa | 0 | .135 | .27 |
| 0 cc/sec | | | |
| T ~ °K | 408 | | |
| $N_{RA}$ | 42.5 | | |
| MEDIUM | AIR | | |
| LOAD | VAR | | |
| NO. OF LAMINATES | 2 | | |

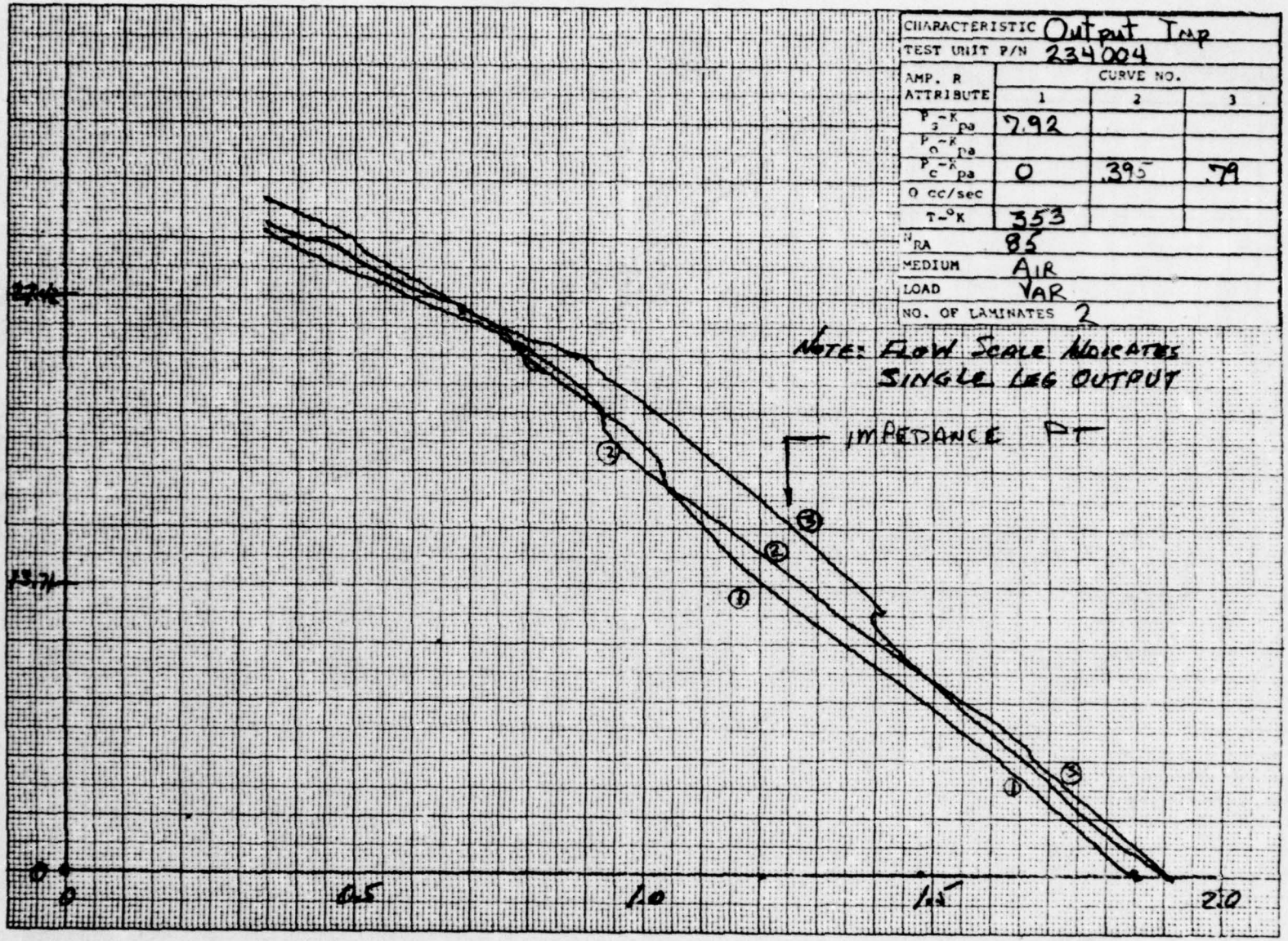


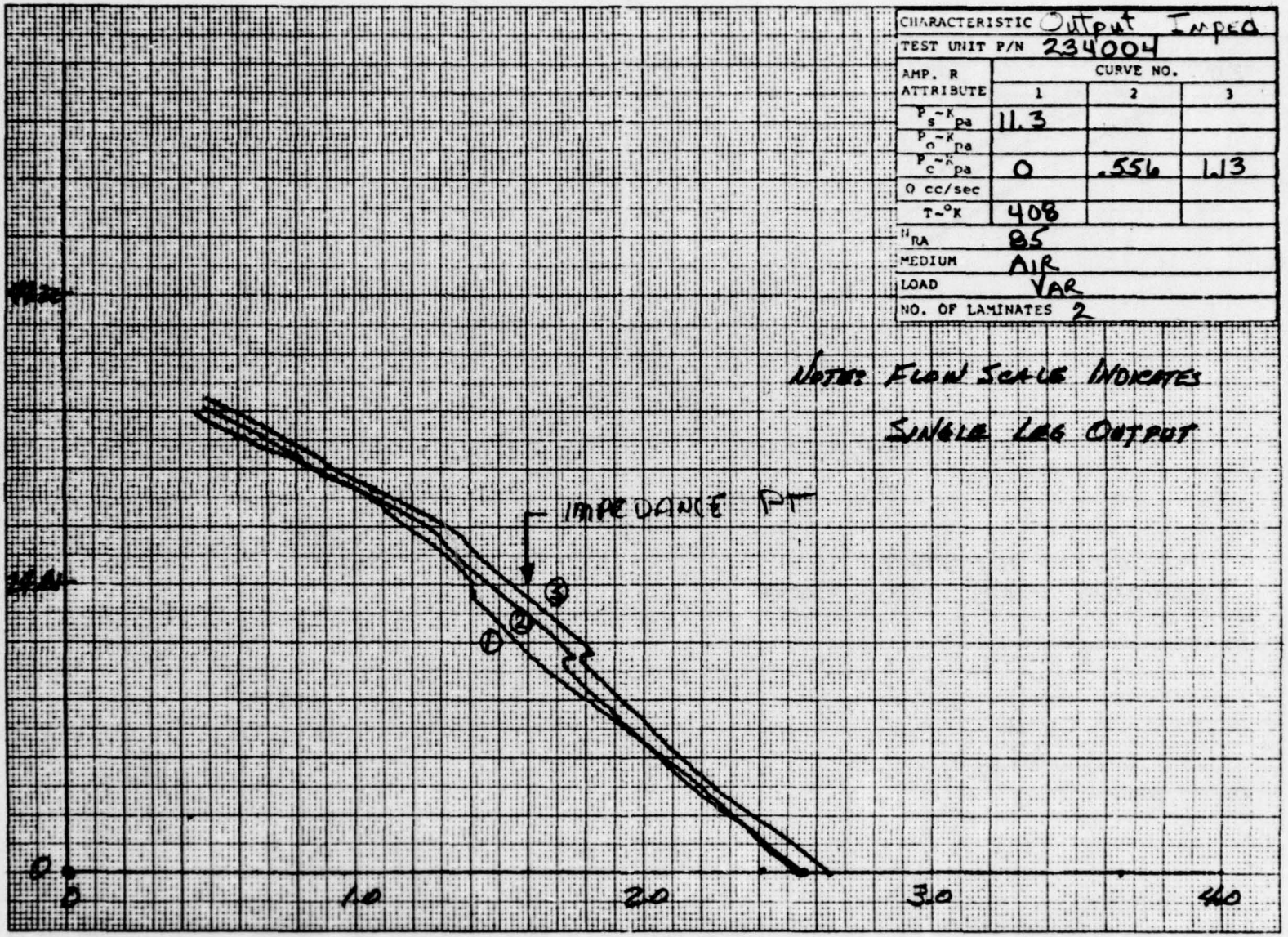

$Q_{01}$, $m^3/sec \times 10^2$

$P_{01}$, kPa

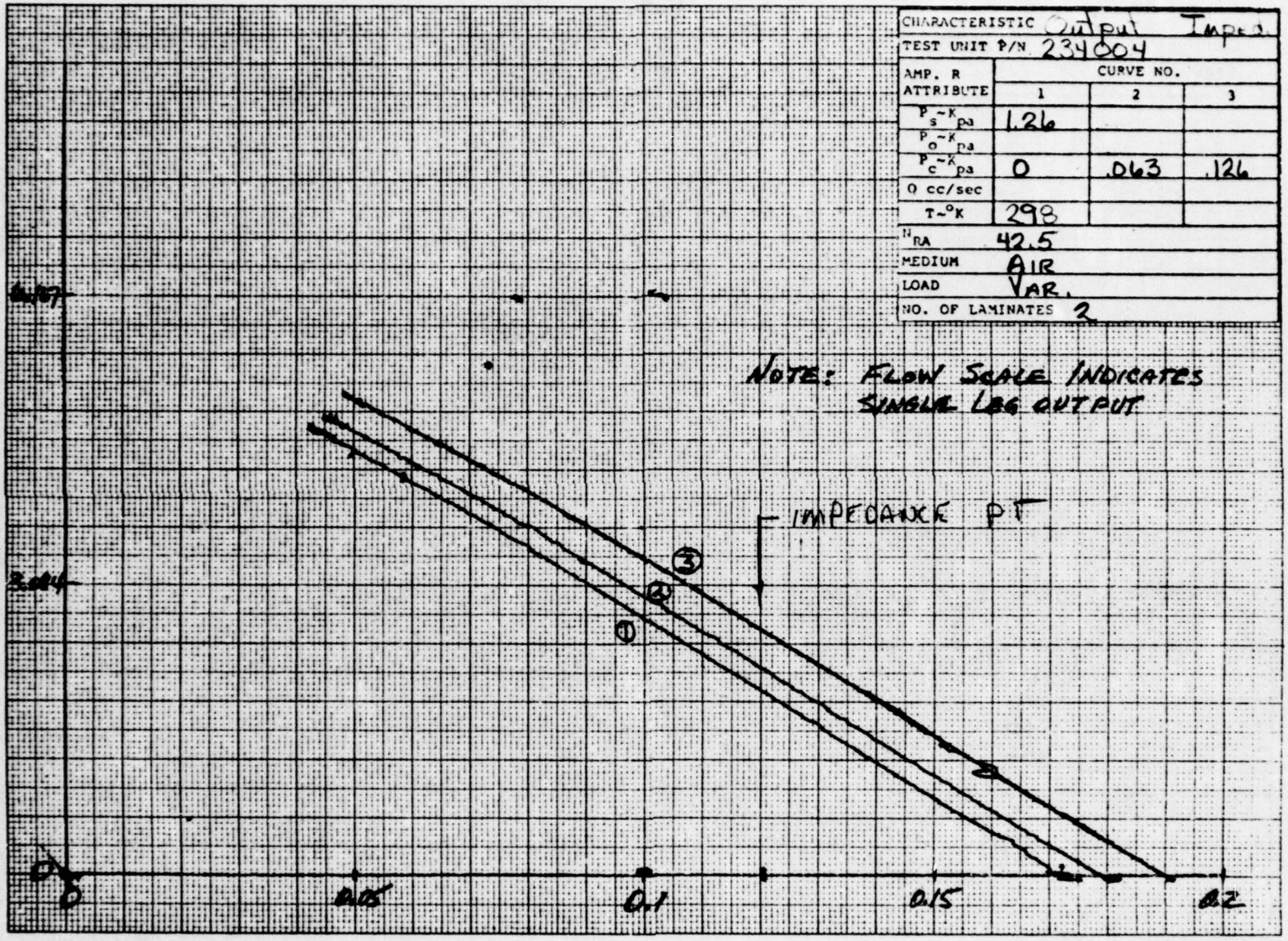
386

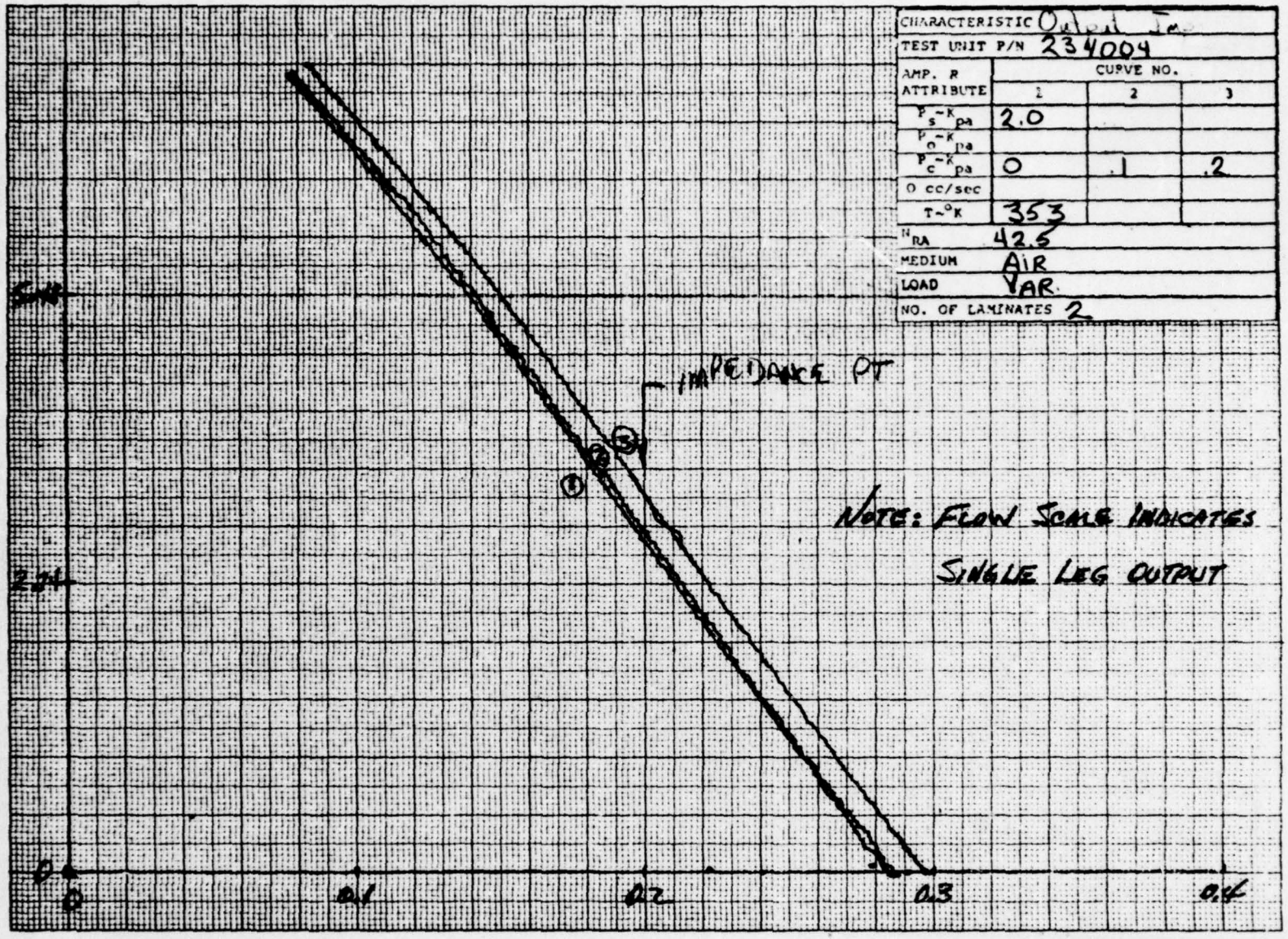

CHARACTERISTIC Output Imp
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$-Kpa 5.22
$P_o$-Kpa
$P_c$-Kpa 0 .26 .52
0 cc/sec
T-°K 298
$N_{RA}$ 85
MEDIUM AIR
LOAD VAR.
NO. OF LAMINATES 2
NOTE: FLOW SCALE INDICATES SINGLE LEG OUTPUT
IMPEDANCE PT
$Q_{01}$, $M^3$/SEC X $10^7$
$P_{01}$, kPa
0
.5
1.0
1.5
2.0

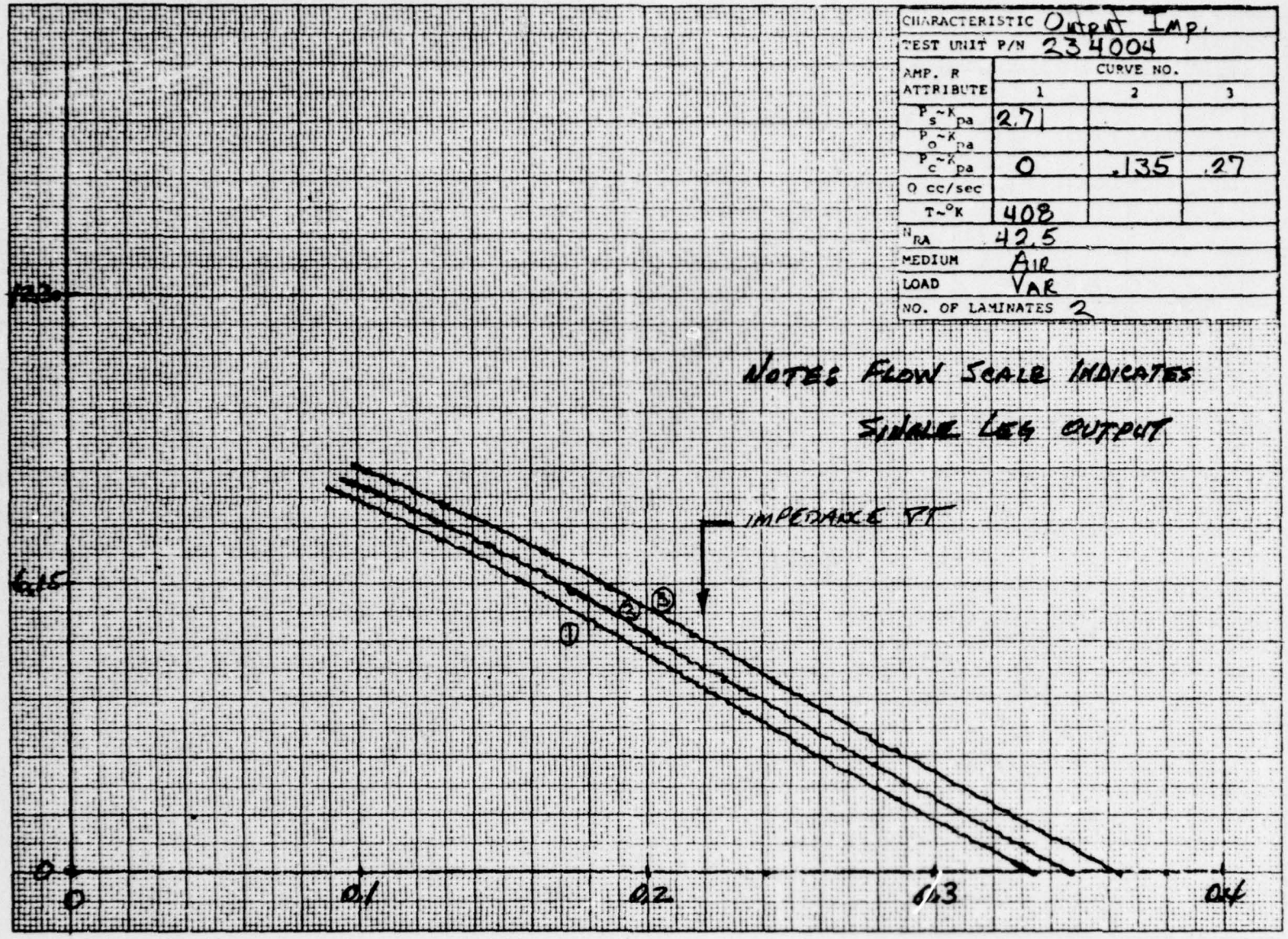

CHARACTERISTIC Output Imp
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s - K_{Pa}$ 7.92
$P_o - K_{Pa}$
$P_c - K_{Pa}$ 0 .395 .79
0 cc/sec
$T - {}^\circ K$ 353
$N_{RA}$ 85
MEDIUM AIR
LOAD VAR
NO. OF LAMINATES 2
NOTE: FLOW SCALE INDICATES SINGLE LEG OUTPUT
IMPEDANCE PT
0
0.5
1.0
1.5
2.0
$Q_{01}$, $m^3/sec \times 10^2$
$P_{01}$, kPa

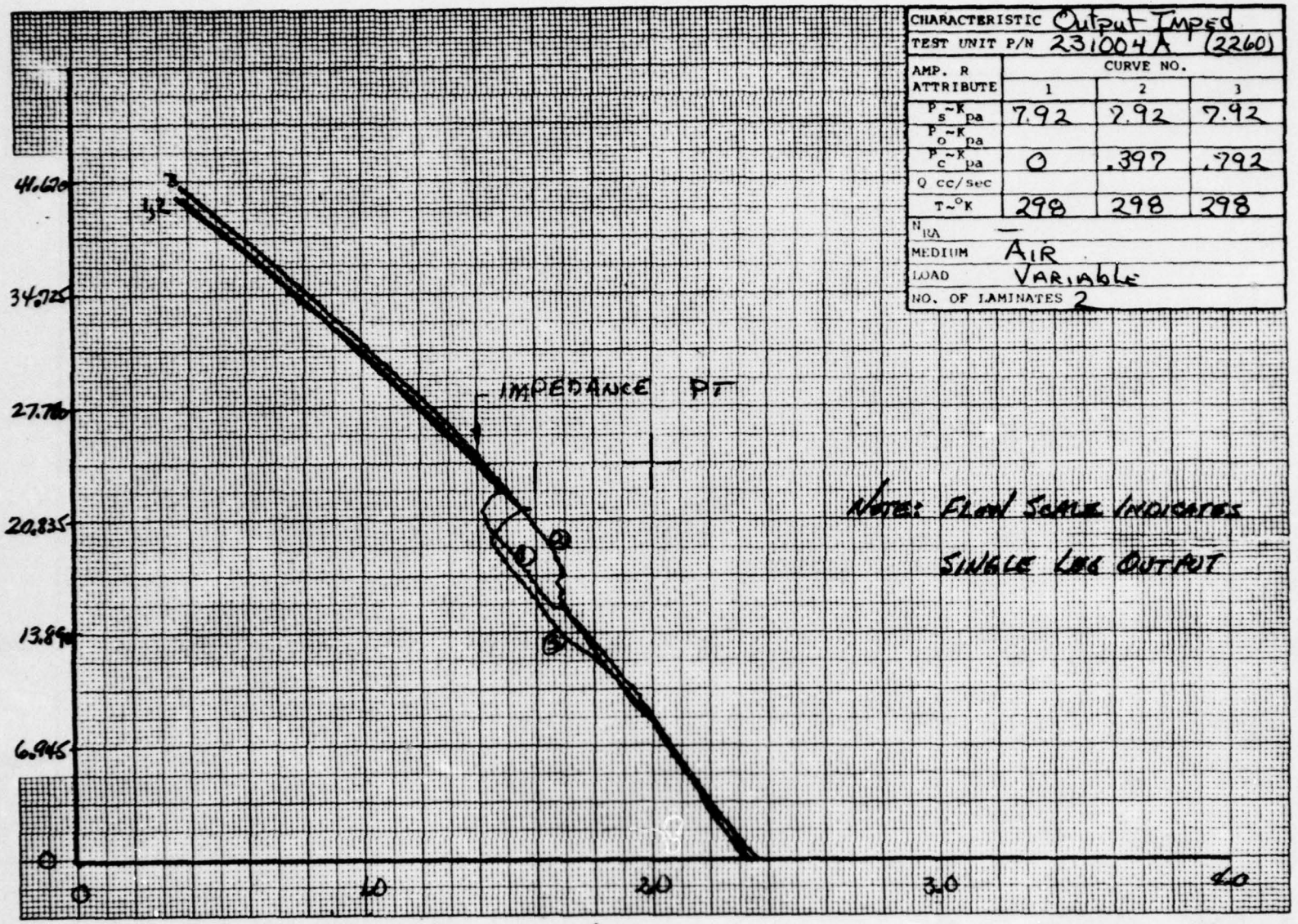

CHARACTERISTIC Output Impedance
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$-Kpa 11.3
$P_o$-Kpa
$P_c$-Kpa 0 .556 1.13
Q cc/sec
T-°K 408
$\eta_{RA}$ 85
MEDIUM AIR
LOAD VAR
NO. OF LAMINATES 2
NOTE: FLOW SCALE INDICATES
SINGLE LEG OUTPUT
IMPEDANCE PT
1
2
3
0
10
20
30
40
$Q_{01}$, $m^3$/sec x $10^7$
$P_{01}$, kPa

389

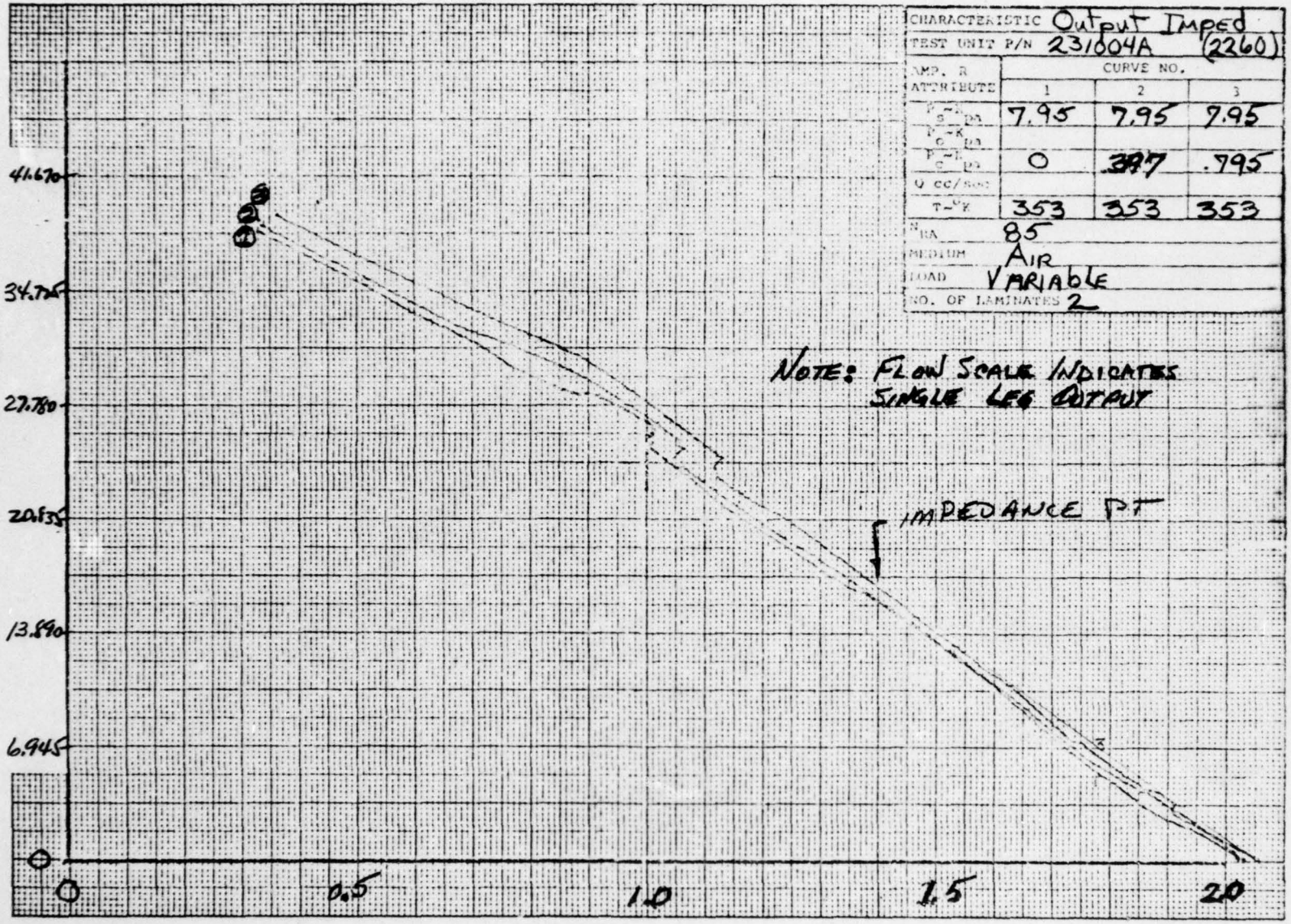

CHARACTERISTIC Output Imped.
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s \sim K_{pa}$ 1.26
$P_o \sim K_{pa}$
$P_c \sim K_{pa}$ 0 .063 .126
Q cc/sec
T~°K 298
$N_{RA}$ 42.5
MEDIUM AIR
LOAD VAR.
NO. OF LAMINATES 2
NOTE: FLOW SCALE INDICATES SINGLE LOG OUTPUT
IMPEDANCE PT
0
0.05
0.1
0.15
0.2
$Q_{01}$, $m^3/sec \times 10^7$
$P_{01}$, kPa

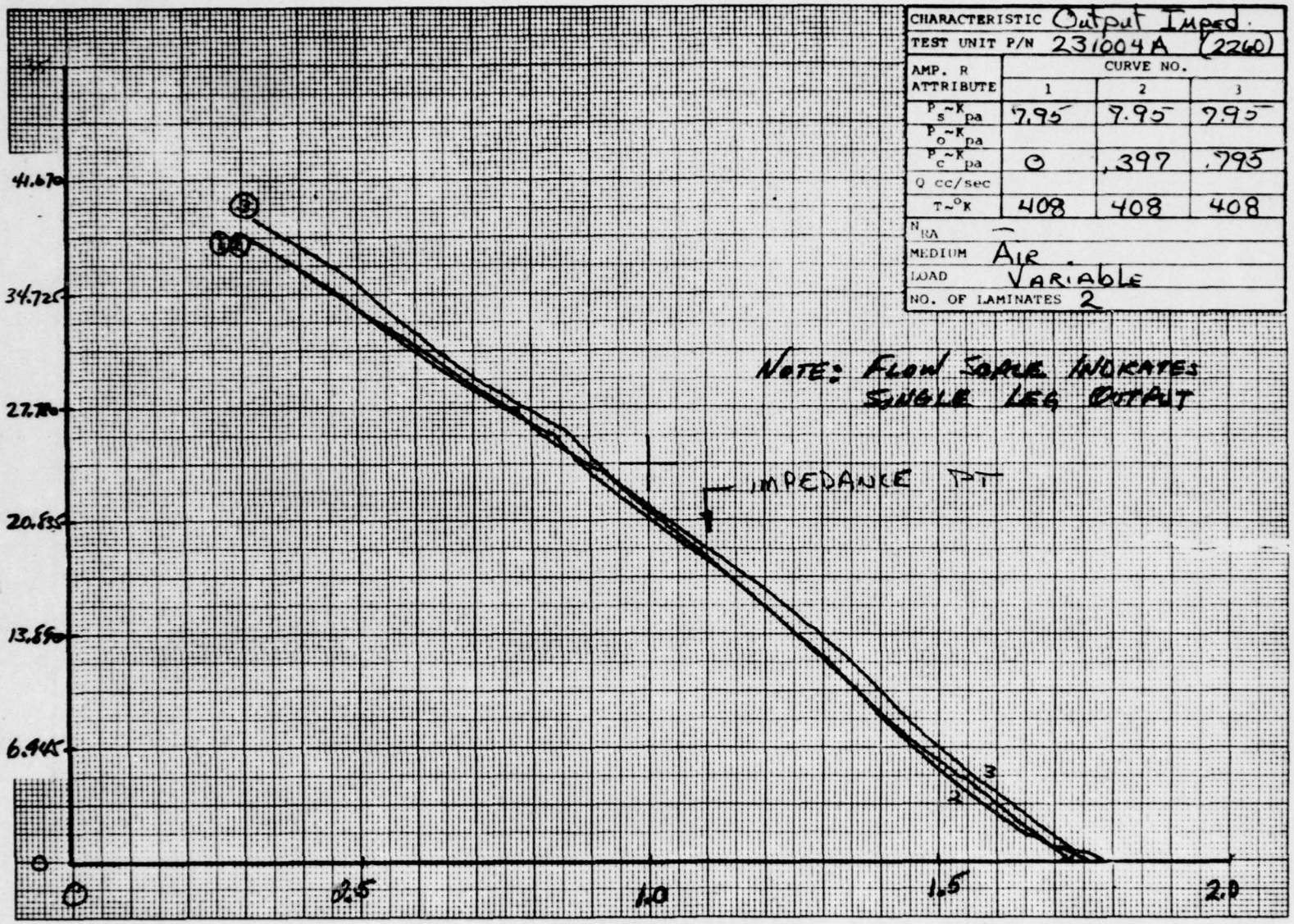

CHARACTERISTIC Output Ps
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$-Kpa 2.0
$P_o$-Kpa
$P_c$-Kpa 0 .1 .2
0 cc/sec
T-°K 353
$N_{RA}$ 42.5
MEDIUM AIR
LOAD VAR.
NO. OF LAMINATES 2
IMPEDANCE PT
NOTE: FLOW SCALE INDICATES SINGLE LEG OUTPUT
$Q_{01}$, $M^3$/SEC X10$^2$
$P_{01}$, KPa
0.1
0.2
0.3
0.4

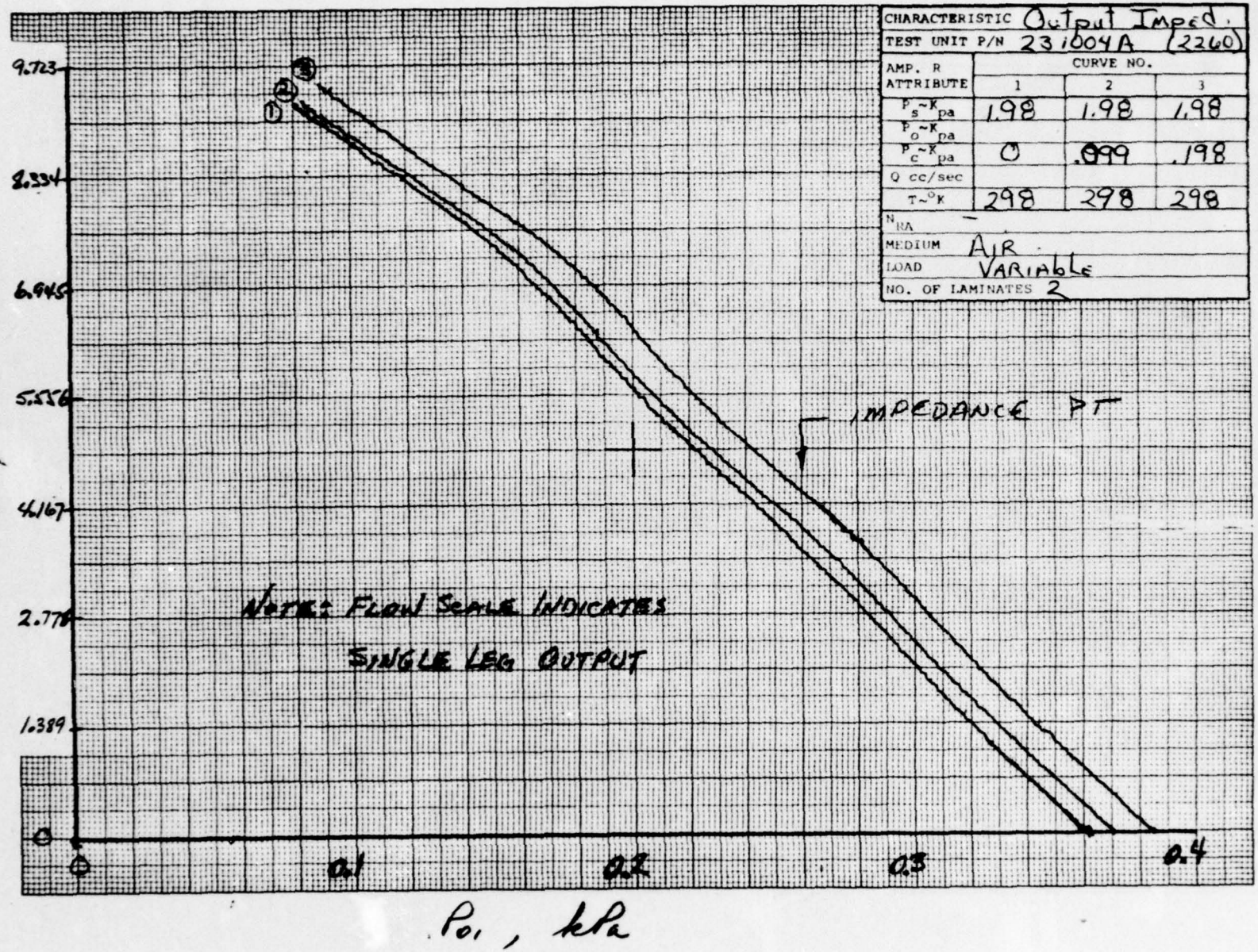

CHARACTERISTIC Output Imp.
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa 2.71
$P_o$~K pa
$P_c$~K pa 0 .135 .27
0 cc/sec
T~°K 408
$N_{RA}$ 42.5
MEDIUM AIR
LOAD VAR
NO. OF LAMINATES 3
NOTES: FLOW SCALE INDICATES SINGLE LEG OUTPUT
IMPEDANCE PT
1
2
3
0
0.1
0.2
0.3
0.4
$Q_{01}$, $m^3/sec \times 10^7$
$P_{01}$, kPa

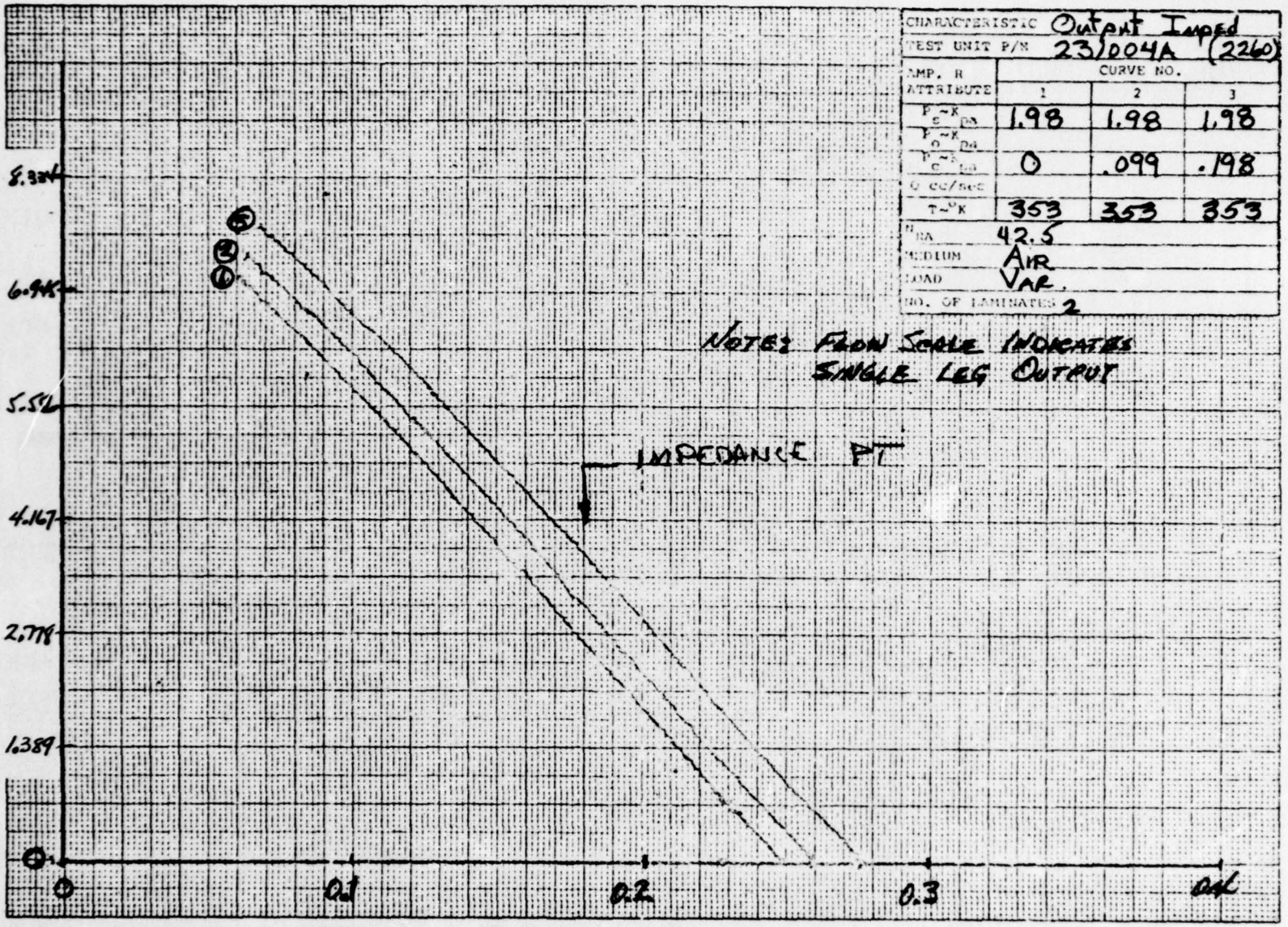

CHARACTERISTIC Output Imped
TEST UNIT P/N 231004A (2260)
AMP. R ATTRIBUTE
CURVE NO.
1 2 3
$P_s$~Kpa 7.92 7.92 7.92
$P_o$~Kpa
$P_c$~Kpa 0 .397 .792
Q cc/sec
T~°K 298 298 298
$N_{RA}$ —
MEDIUM AIR
LOAD VARIABLE
NO. OF LAMINATES 2
41.620
34.725
27.780
20.835
13.890
6.945
0
10
20
30
40
IMPEDANCE PT
Note: Flow Scale Inoperative
Single Log Output
$P_{01}$, $m^3/sec \times 10^7$
$P_{01}$, kPa

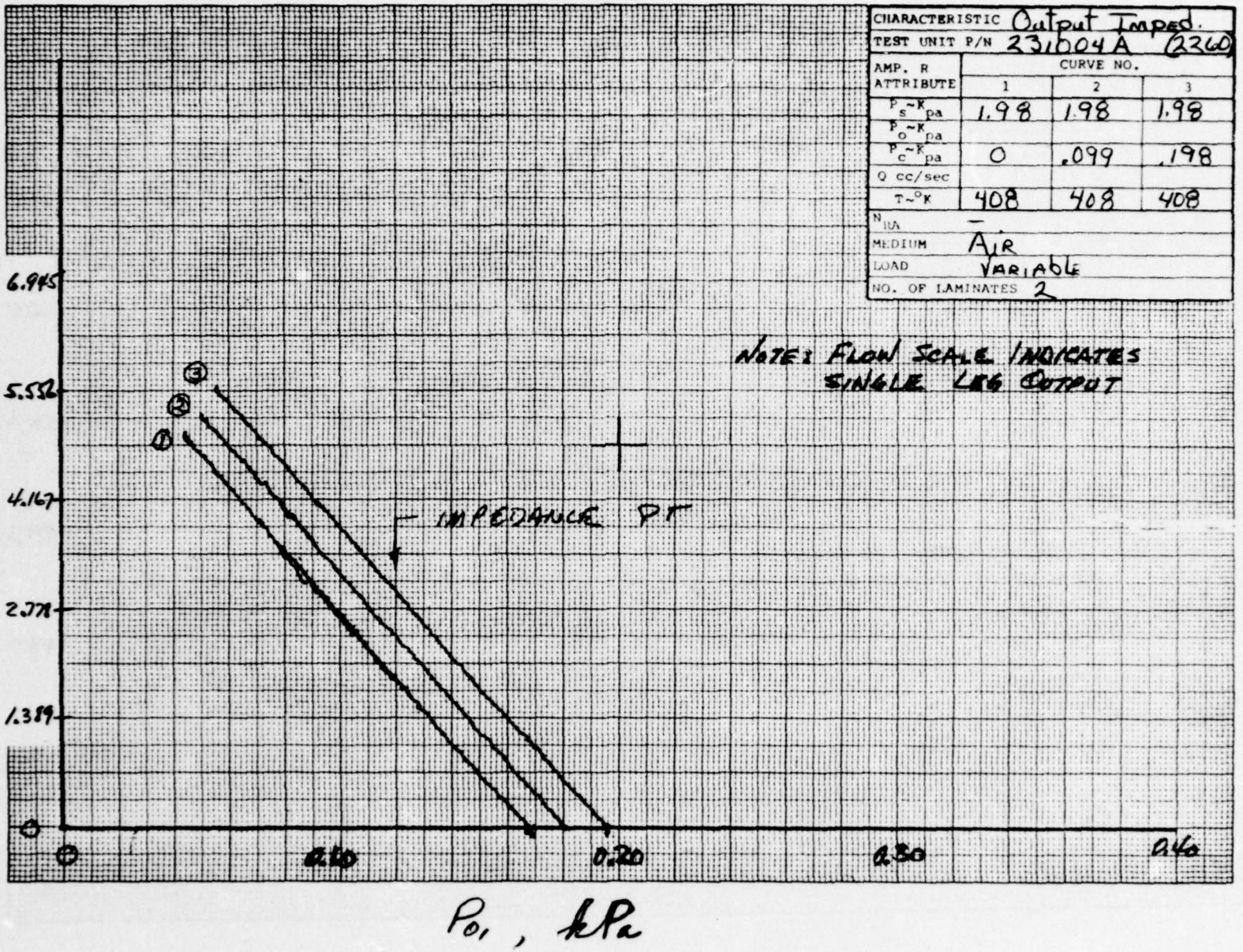
393

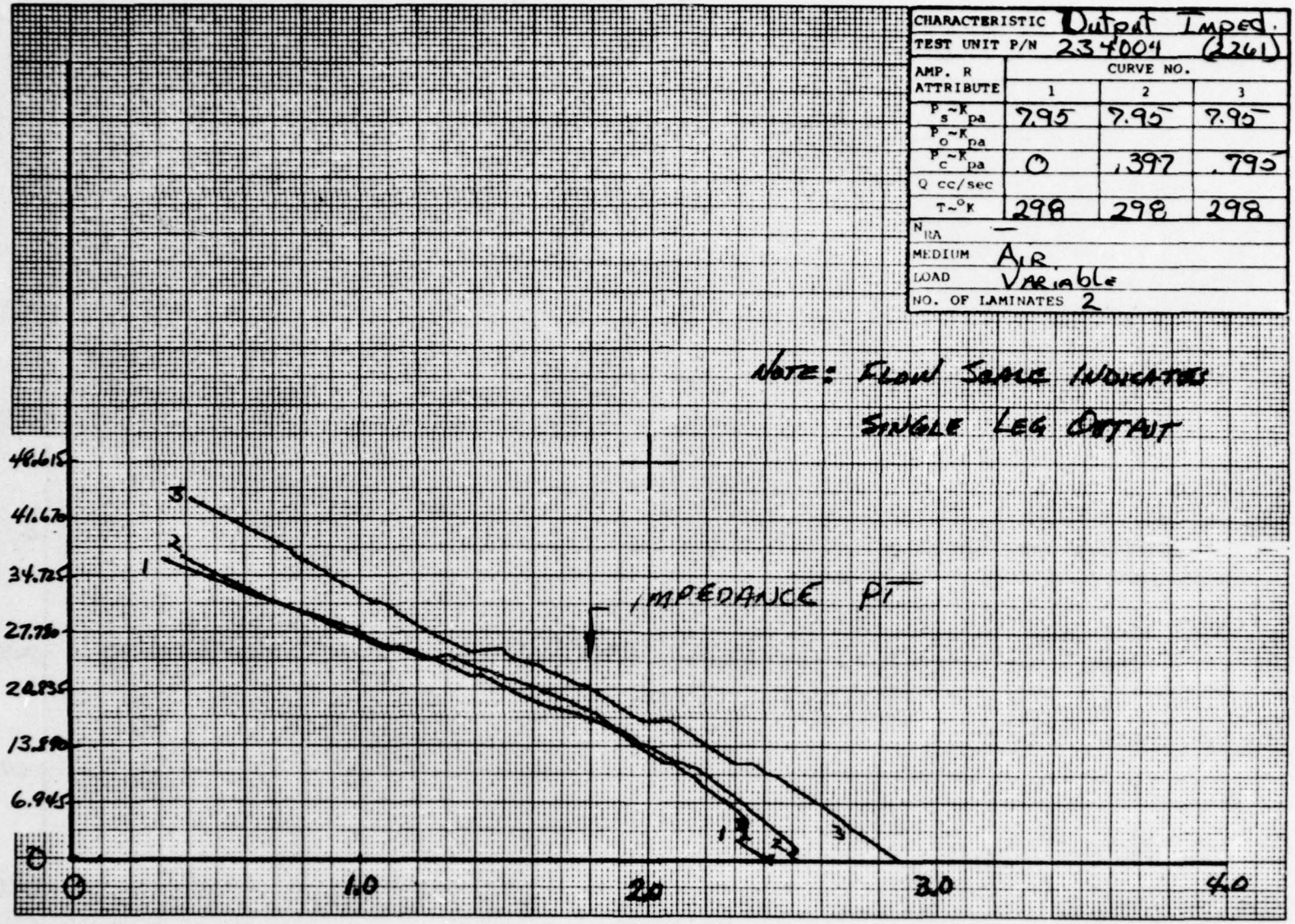

CHARACTERISTIC Output Imped
TEST UNIT P/N 231804A (2260)
AMP. R ATTRIBUTE
CURVE NO.
1 2 3
P-S 7.95 7.95 7.95
P-K
P-T 0 .397 .795
Q cc/sec
T-°K 353 353 353
N RA 85
MEDIUM AIR
LOAD VARIABLE
NO. OF LAMINATES 2
NOTE: FLOW SCALE INDICATES SINGLE LEG OUTPUT
IMPEDANCE PT
41.670
34.725
27.780
20.835
13.890
6.945
0
0
0.5
1.0
1.5
2.0
Po1, m³/sec x 10³
Po1, kPa ...

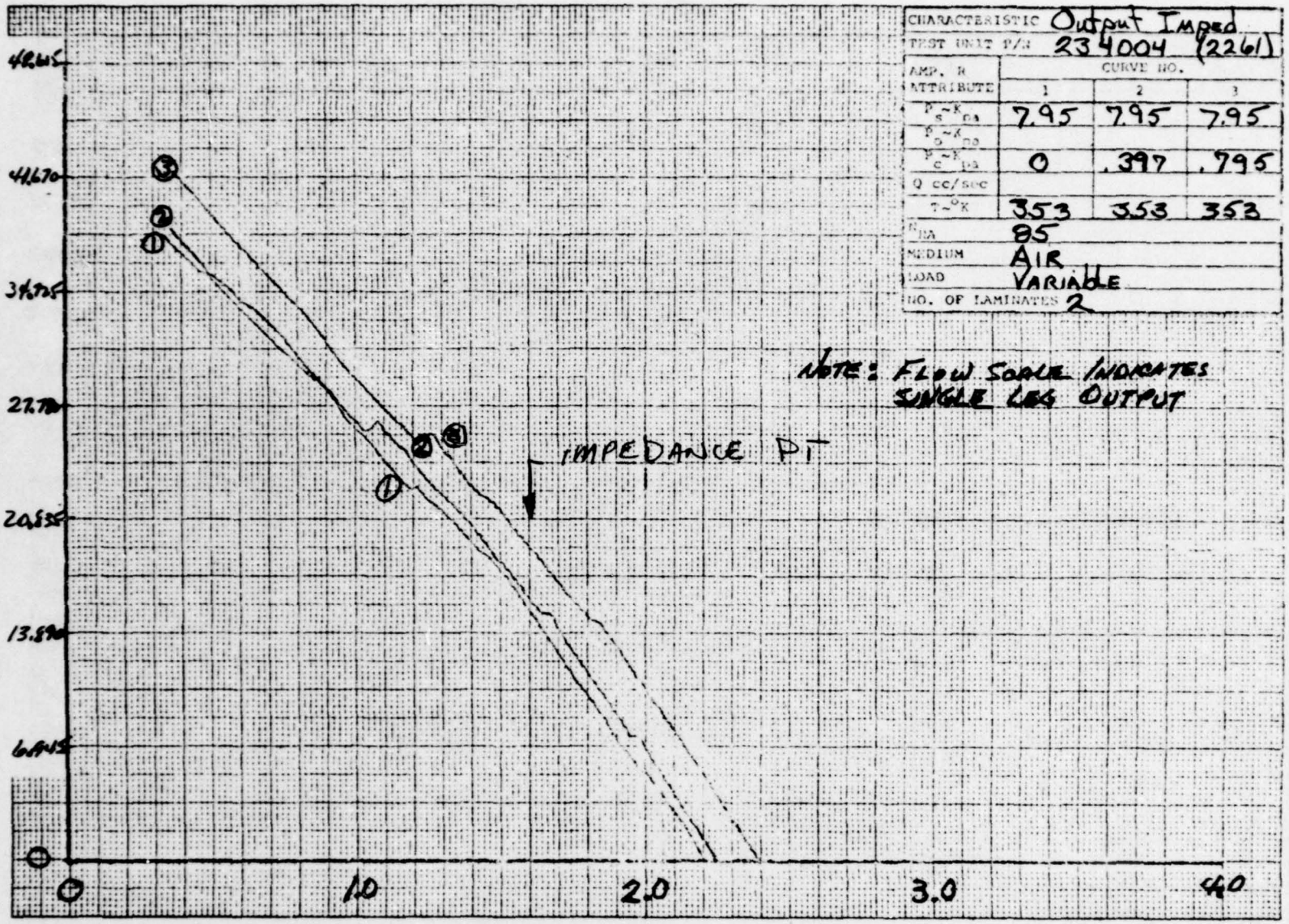

CHARACTERISTIC Output Imped.
TEST UNIT P/N 231004A (2260)
AMP. R ATTRIBUTE
CURVE NO.
1 2 3
$P_s$~Kpa 7.95 7.95 7.95
$P_o$~Kpa
$P_c$~Kpa 0 .397 .795
Q cc/sec
T~°K 408 408 408
$N_{RA}$
MEDIUM Air
LOAD Variable
NO. OF LAMINATES 2
NOTE: FLOW SCALE INDICATES SINGLE LEG OUTPUT
IMPEDANCE PT
41.670
34.725
27.780
20.835
13.890
6.945
0
0
0.5
1.0
1.5
2.0
1
2
3
$Q_{o_1}$, $m^3/sec \times 10^{-7}$
$P_{o_1}$, kPa

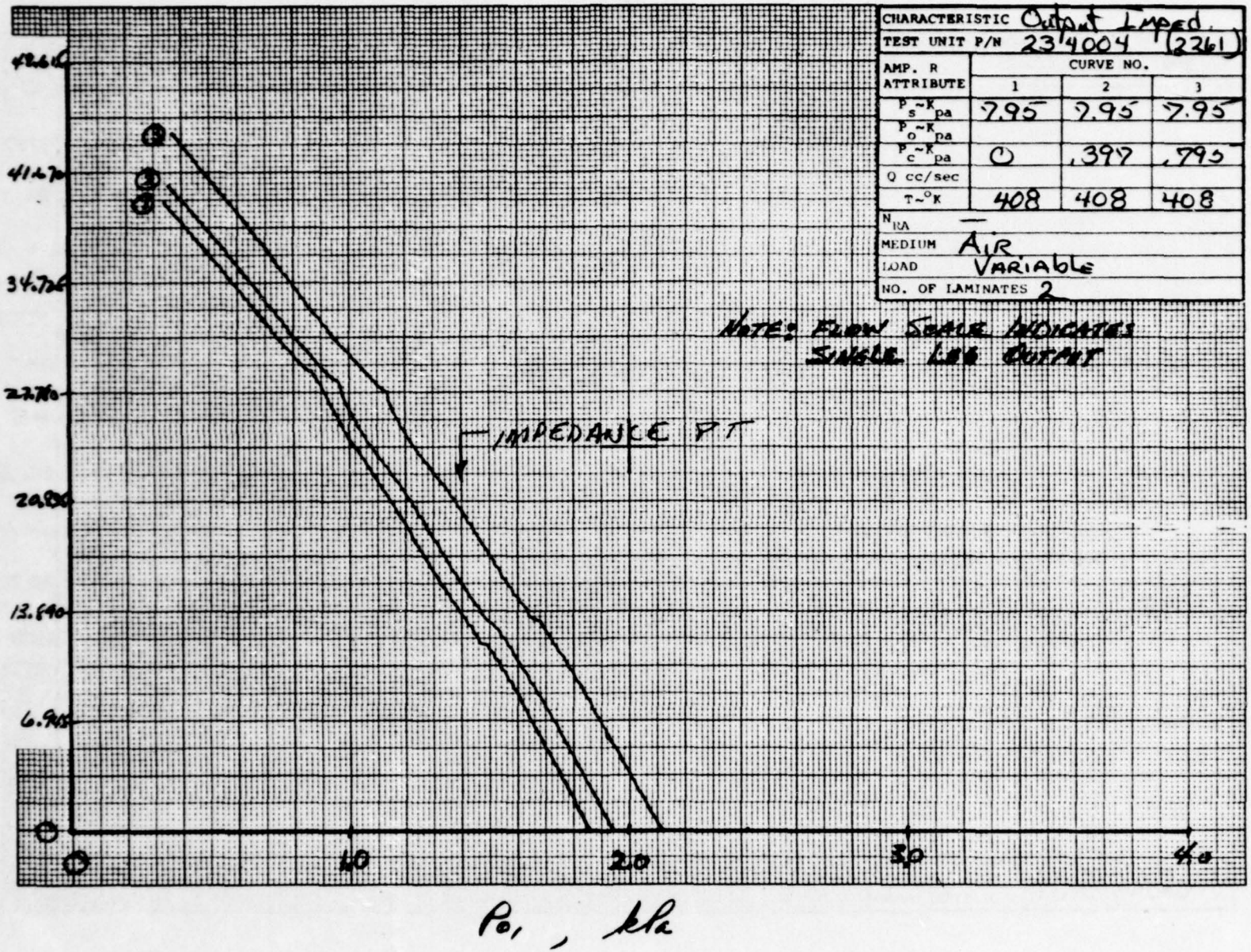

CHARACTERISTIC Output Imped.
TEST UNIT P/N 231004A (2260)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa 1.98 1.98 1.98
$P_o$~Kpa
$P_c$~Kpa 0 .099 .198
Q cc/sec
T~°K 298 298 298
N RA
MEDIUM AIR
LOAD VARIABLE
NO. OF LAMINATES 2
9.723
8.334
6.945
5.556
4.167
2.778
1.389
0
0.1
0.2
0.3
0.4
IMPEDANCE PT
NOTE: FLOW SCALE INDICATES SINGLE LEG OUTPUT
$P_{01}$, $m^3/sec \times 10^7$
$P_{01}$, kPa

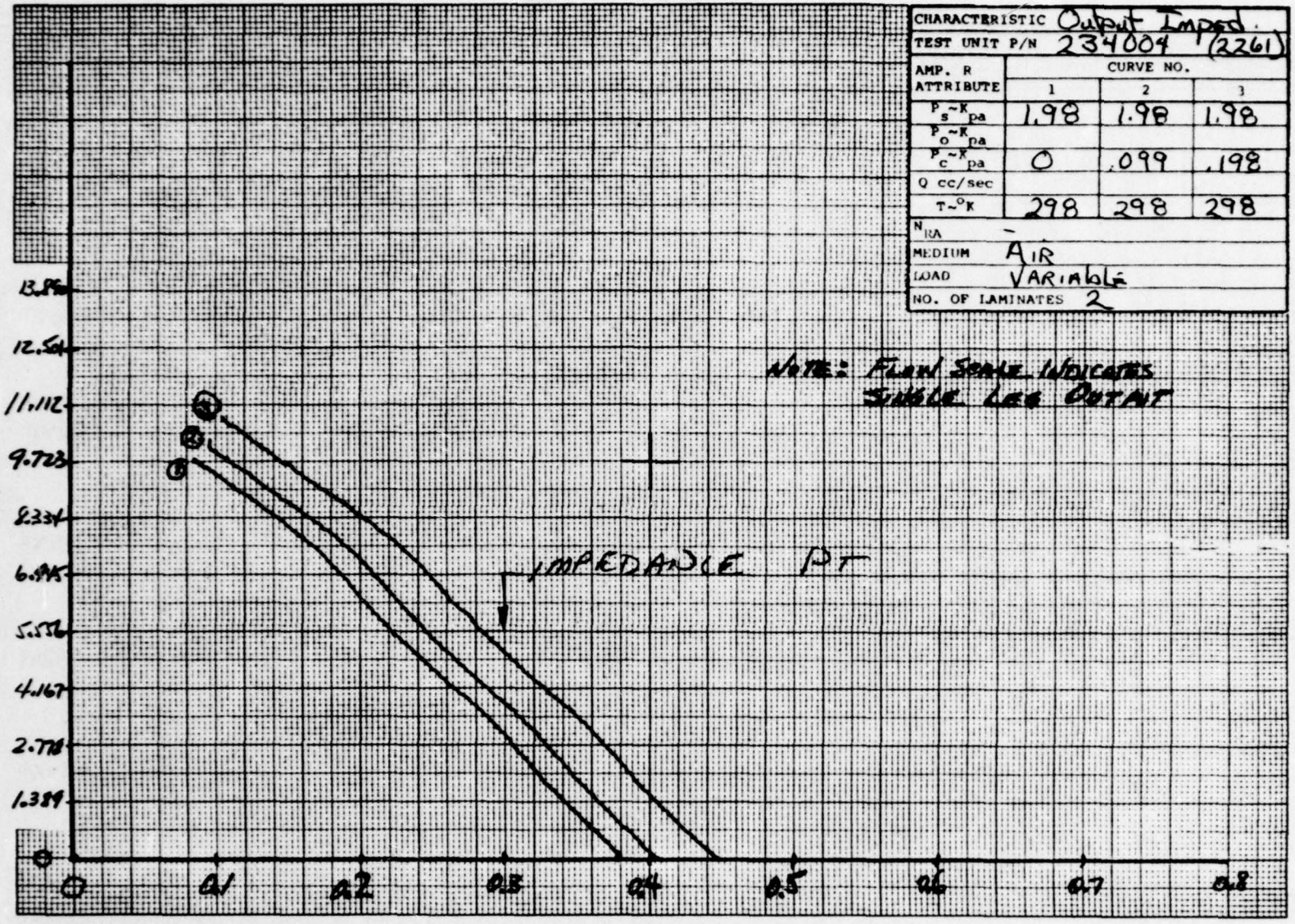

CHARACTERISTIC Output Imped
TEST UNIT P/N 23/004A (2260)
AMP. R ATTRIBUTE
CURVE NO.
1 2 3
1.98 1.98 1.98
0 .099 .198
353 353 353
42.5
AIR
VAR.
2
NOTE: FLOW SCALE INDICATES SINGLE LEG OUTPUT
IMPEDANCE PT
8.334
6.946
5.552
4.167
2.778
1.389
0
0.1
0.2
0.3
Po, m3/sec X10-7
Po, kPa

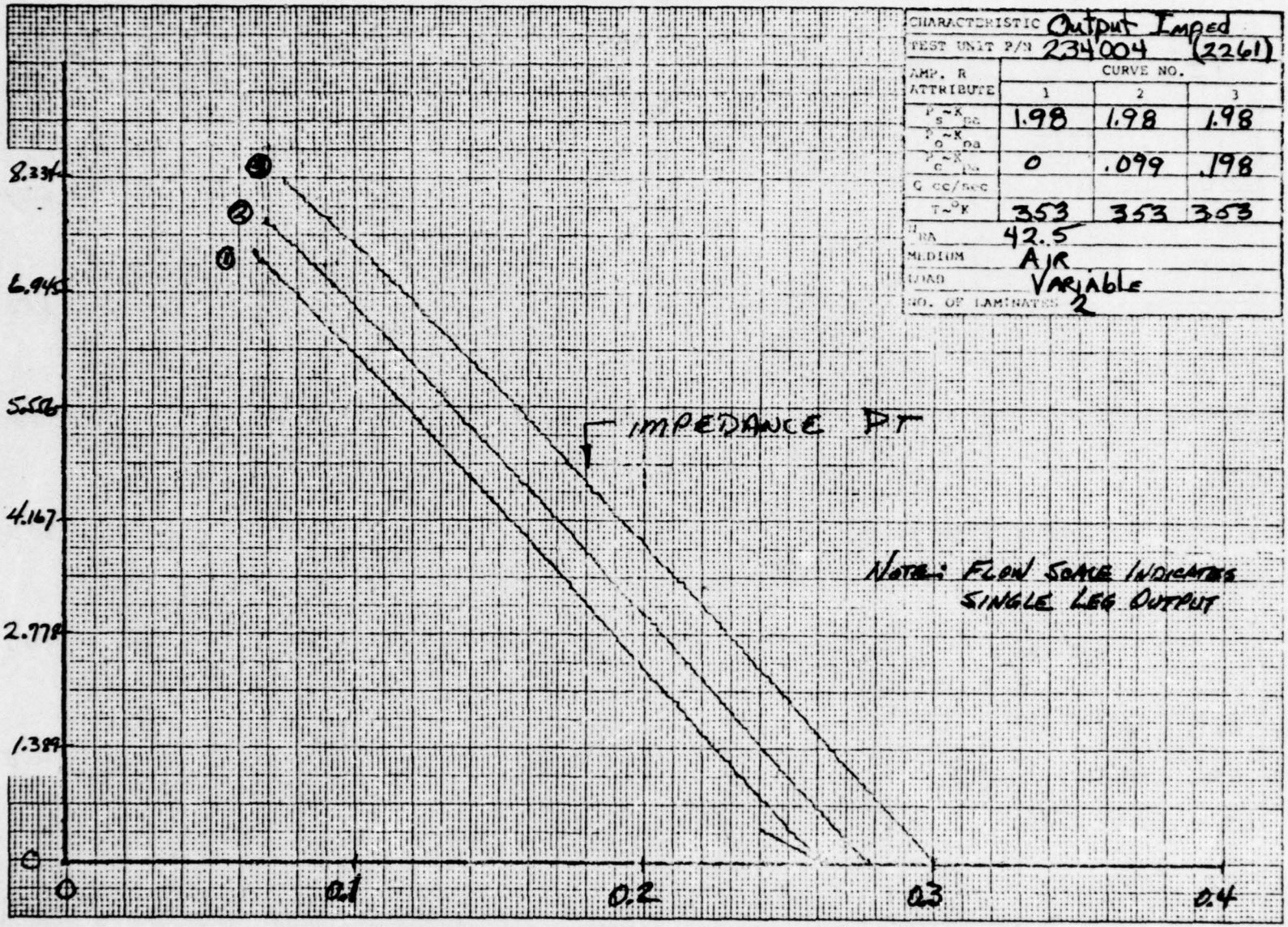

CHARACTERISTIC Output Imped.
TEST UNIT P/N 231604A (2360)
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa 1.98 1.98 1.98
$P_o$~Kpa
$P_c$~Kpa 0 .099 .198
Q cc/sec
T~°K 408 408 408
N/A
MEDIUM Air
LOAD Variable
NO. OF LAMINATES 2
NOTE: FLOW SCALE INDICATES SINGLE LEG OUTPUT
IMPEDANCE PT
6.945
5.552
4.167
2.778
1.389
0
0.10
0.20
0.30
0.40
$Q_{o_1}$, $m^3/sec \times 10^7$
$P_{o_1}$, kPa

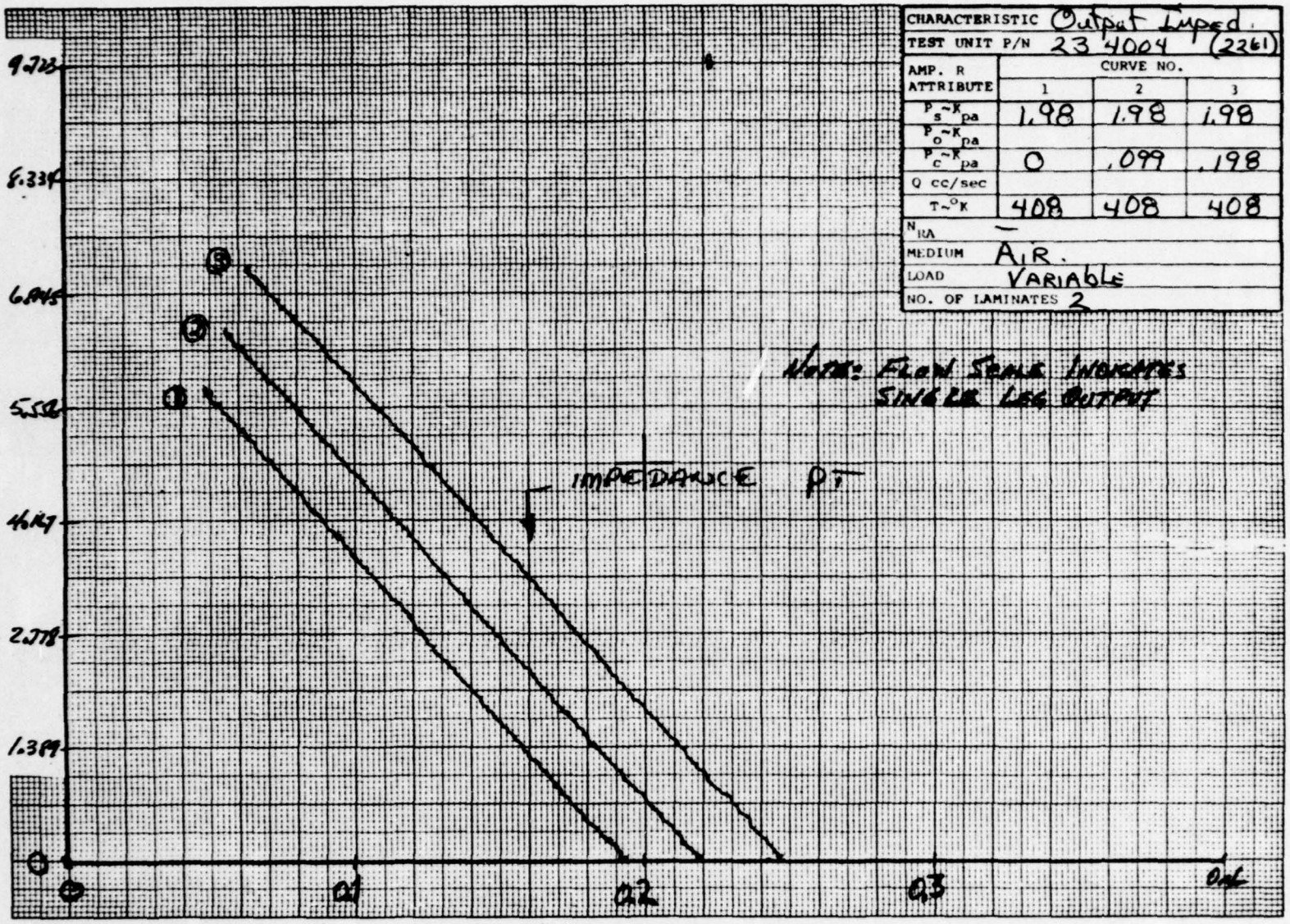

CHARACTERISTIC Output Imped.
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~Kpa 7.95 7.95 7.95
$P_o$~Kpa
$P_c$~Kpa .0 .397 .795
Q cc/sec
T~°K 298 298 298
N RA —
MEDIUM AIR
LOAD Variable
NO. OF LAMINATES 2
NOTE: FLOW SCALE INDICATES SINGLE LEG OUTPUT
IMPEDANCE PT
$P_{o1}$, m³/sec X10⁷
48.615
41.670
34.725
27.780
20.835
13.890
6.945
0
1.0
2.0
3.0
4.0
$P_{o1}$, kPa

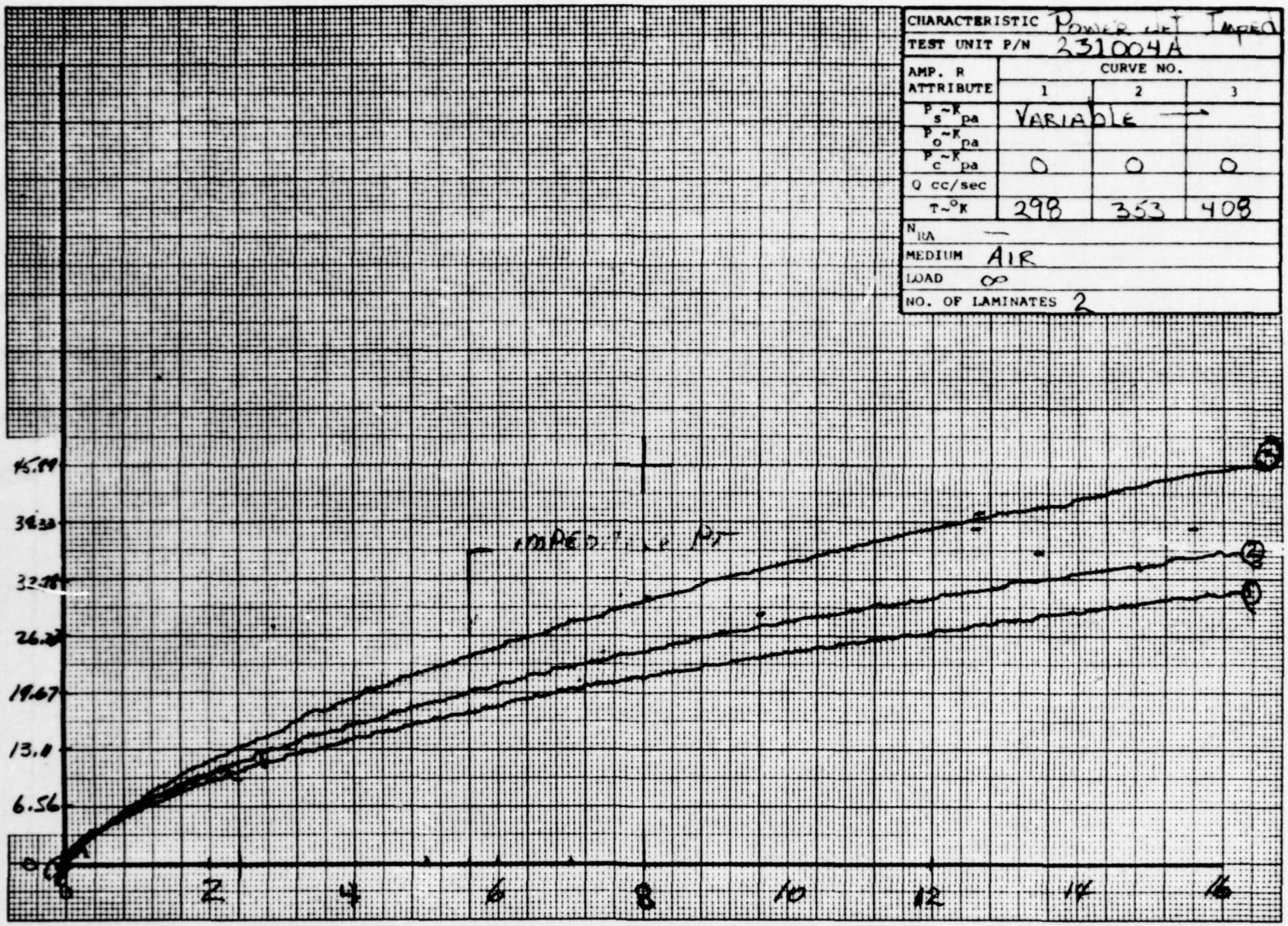

CHARACTERISTIC Output Imped
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO.
1 2 3
$P_S \sim K_{DA}$ 7.95 7.95 7.95
$P_O \sim K_{DO}$
$P_C \sim K_{DA}$ 0 .397 .795
Q cc/sec
$T \sim {}^{o}K$ 353 353 353
$R_{DA}$ 85
MEDIUM AIR
LOAD VARIABLE
NO. OF LAMINATES 2
NOTE: FLOW SCALE INDICATES SINGLE LEG OUTPUT
IMPEDANCE PT
4.0
3.0
2.0
1.0
0
$P_{01}$, $m^3/sec \times 10^7$
$P_{01}$, kPa

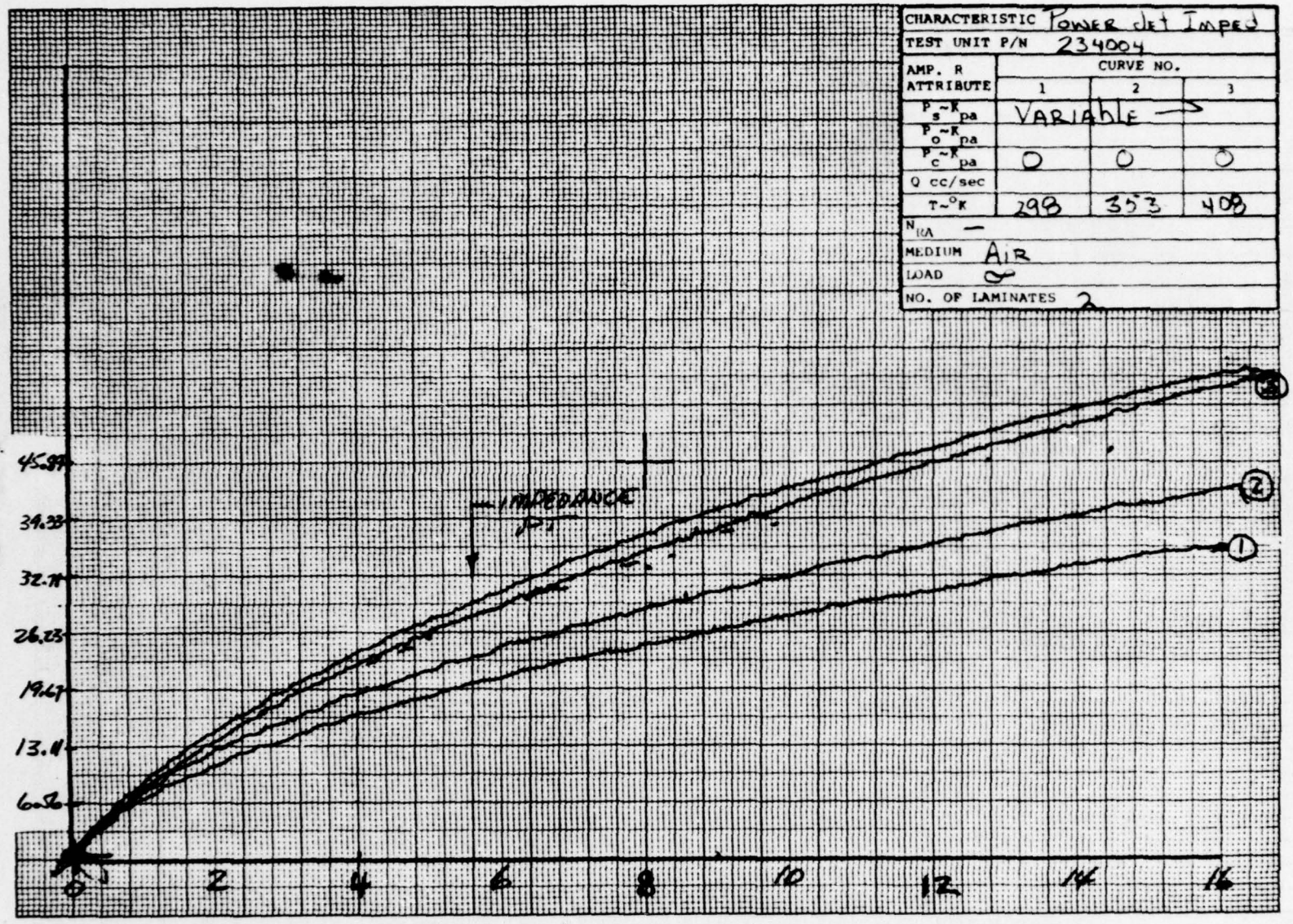

CHARACTERISTIC Output Imped.
TEST UNIT P/N 234004 (2361)
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa 7.95 7.95 7.95
$P_o$~K pa
$P_c$~K pa 0 .397 .795
Q cc/sec
T~°K 408 408 408
$N_{RA}$ —
MEDIUM AIR
LOAD VARIABLE
NO. OF LAMINATES 2
NOTE: FLOW SCALE INDICATES SINGLE LEG OUTPUT
IMPEDANCE PT
$P_{O_1}$, $m^3$/sec X $10^7$
42.66
41.47
34.72
22.78
20.80
13.64
6.94
0
10
20
30
40
$P_{O_1}$, kPa


CHARACTERISTIC Output Imped.
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO.
1 2 3
$P_s$~K pa 1.98 1.98 1.98
$P_o$~K pa
$P_c$~K pa 0 .099 .198
Q cc/sec
T~°K 298 298 298
N RA
MEDIUM AIR
LOAD VARIABLE
NO. OF LAMINATES 2
NOTE: FLOW SCALE INDICATES SUBSONIC LESS OUTPUT
IMPEDANCE PT
$Q_{01}$, $m^3/sec \times 10^7$
13.890
12.504
11.112
9.723
8.334
6.945
5.556
4.167
2.778
1.389
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
$P_{01}$, kPa


CHARACTERISTIC Output Imped
TEST UNIT P/N 234004 (2261)
AMP. R ATTRIBUTE
CURVE NO.
1 2 3
$P_s$ ~ K Pa 1.98 1.98 1.98
$P_o$ ~ K Pa
$P_c$ ~ K Pa 0 .099 .198
Q cc/sec
T ~ °K 353 353 353
$I_{BA}$ 42.5
MEDIUM AIR
LOAD VARIABLE
NO. OF LAMINATES 2
IMPEDANCE PT
NOTE: FLOW SAME INDICATES SINGLE LEG OUTPUT
8.334
6.945
5.556
4.167
2.778
1.389
0
0.1
0.2
0.3
0.4
$Q_{01}$, $m^3/sec \times 10^7$
$P_{01}$; kPa


CHARACTERISTIC Output Imped.
TEST UNIT P/N 23 4004 (2261)
AMP. R ATTRIBUTE
CURVE NO.
1 2 3
$P_s$~K pa 1.98 1.98 1.98
$P_o$~K pa
$P_c$~K pa 0 .099 .198
Q cc/sec
T~°K 408 408 408
$N_{RA}$ —
MEDIUM AIR.
LOAD VARIABLE
NO. OF LAMINATES 2
NOTE: FLOW SCALE INDICATES SINGLE LEG OUTPUT
IMPEDANCE $P_T$
9.723
8.334
6.945
5.556
4.167
2.778
1.389
0
0.1
0.2
0.3
$P_{01}$, $m^3/sec \times 10^7$
$P_{01}$, kPa


CHARACTERISTIC Power Jet Impact
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~ Kpa
VARIABLE →
$P_o$ ~ Kpa
$P_c$ ~ Kpa
0
0
0
Q cc/sec
T ~ °K
298
353
408
$N_{RA}$ —
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
$Q_s$, $m^3$/sec X $10^7$
15.89
13.0
6.56
0
2
4
6
8
10
12
14
16
$P_s$, kPa

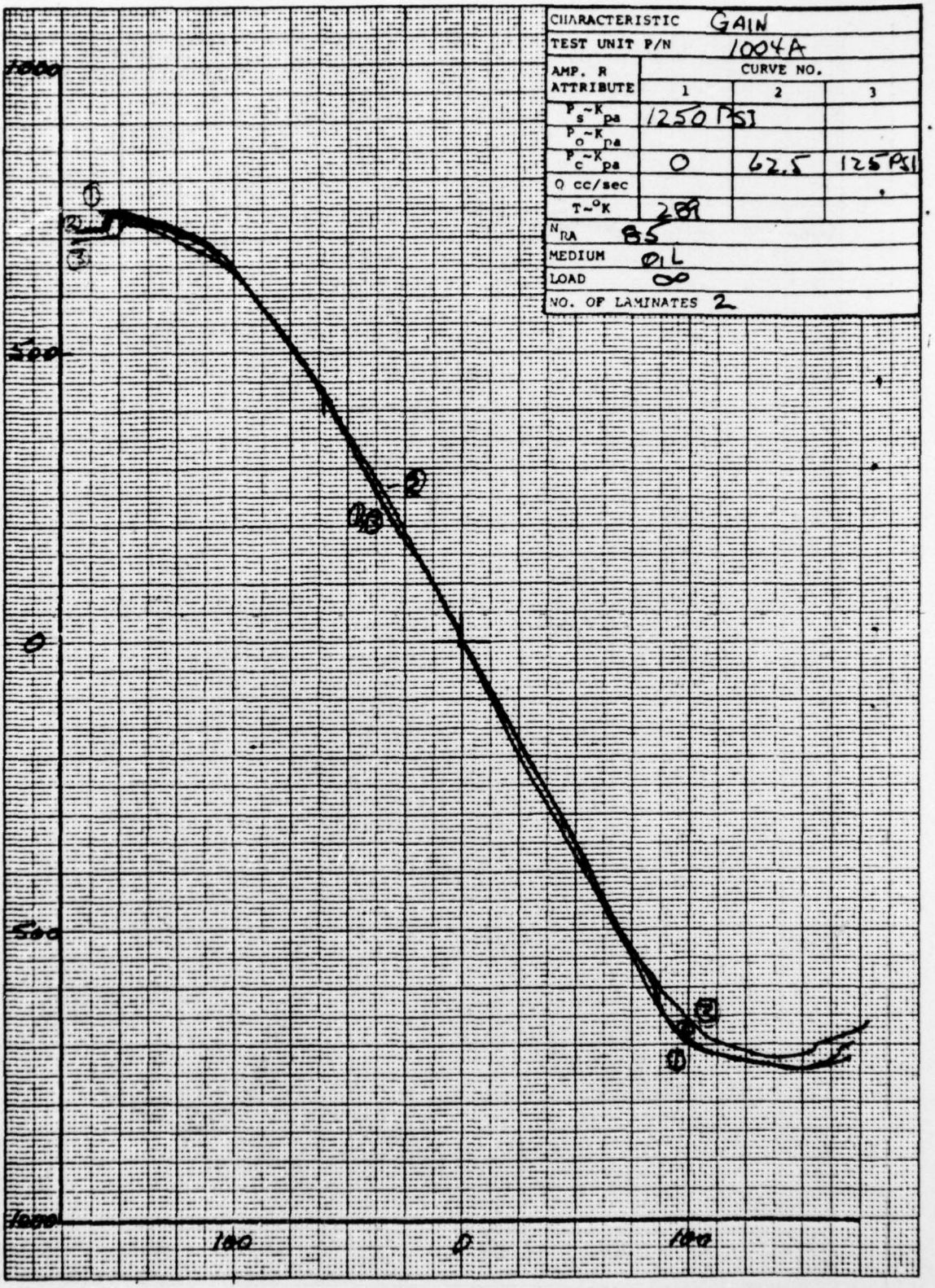

CHARACTERISTIC Power det Imped
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa VARIABLE →
$P_o$~K pa
$P_c$~K pa 0 0 0
Q cc/sec
T~°K 298 353 408
$N_{RA}$ —
MEDIUM AIR
LOAD ∞
NO. OF LAMINATES 2
$Q_s$, $m^3$/sec X $10^7$
45.89
39.33
32.78
26.23
19.67
13.11
6.56
0
2
4
6
8
10
12
14
16
IMPEDANCE
$P_s$, kPa
406

APPENDIX B

HYDRAULIC TEST DATA

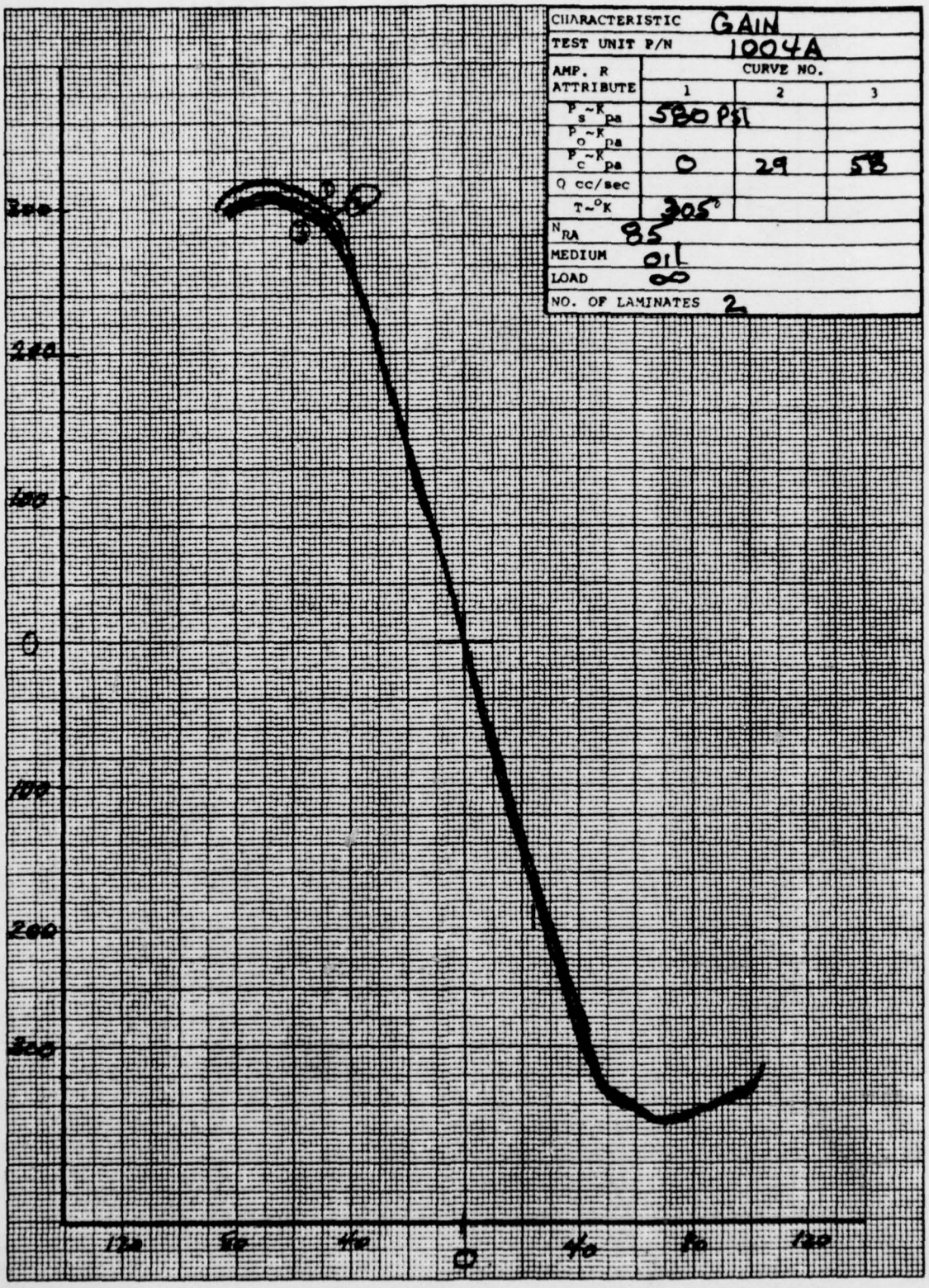
TABLE OF CONTENTS

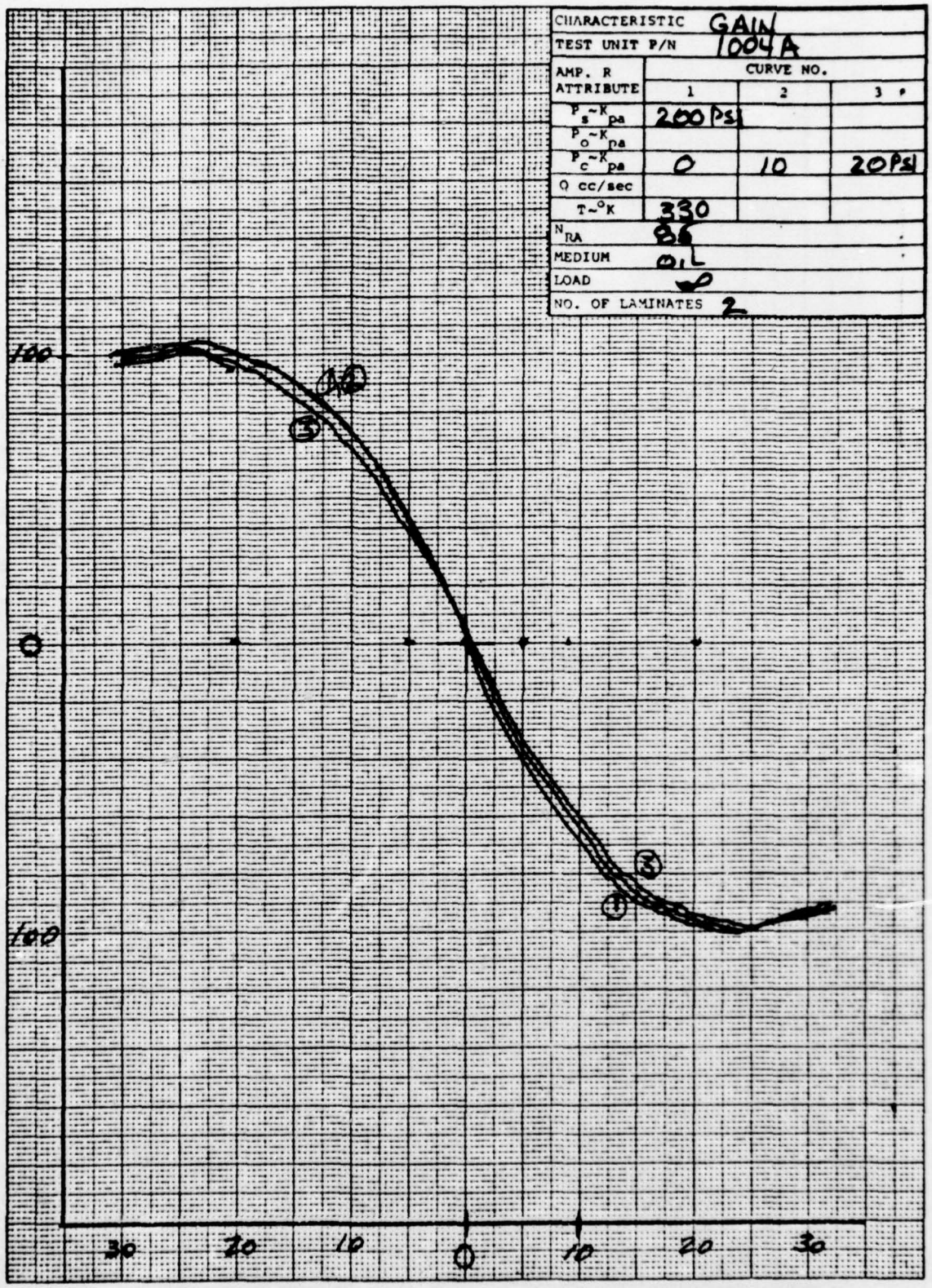

| | PAGE |
|---|---|
| GAIN | 409 THRU 468 |
| COMMON MODE REJECTION | 469 THRU 498 |
| INPUT IMPEDANCE, CENTERED JET | 499 THRU 510 |
| INPUT IMPEDANCE, DEFLECTED JET | 511 THRU 534 |
| OUTPUT IMPEDANCE | 535 THRU 546 |
| POWER JET IMPEDANCE | 547 THRU 552 |

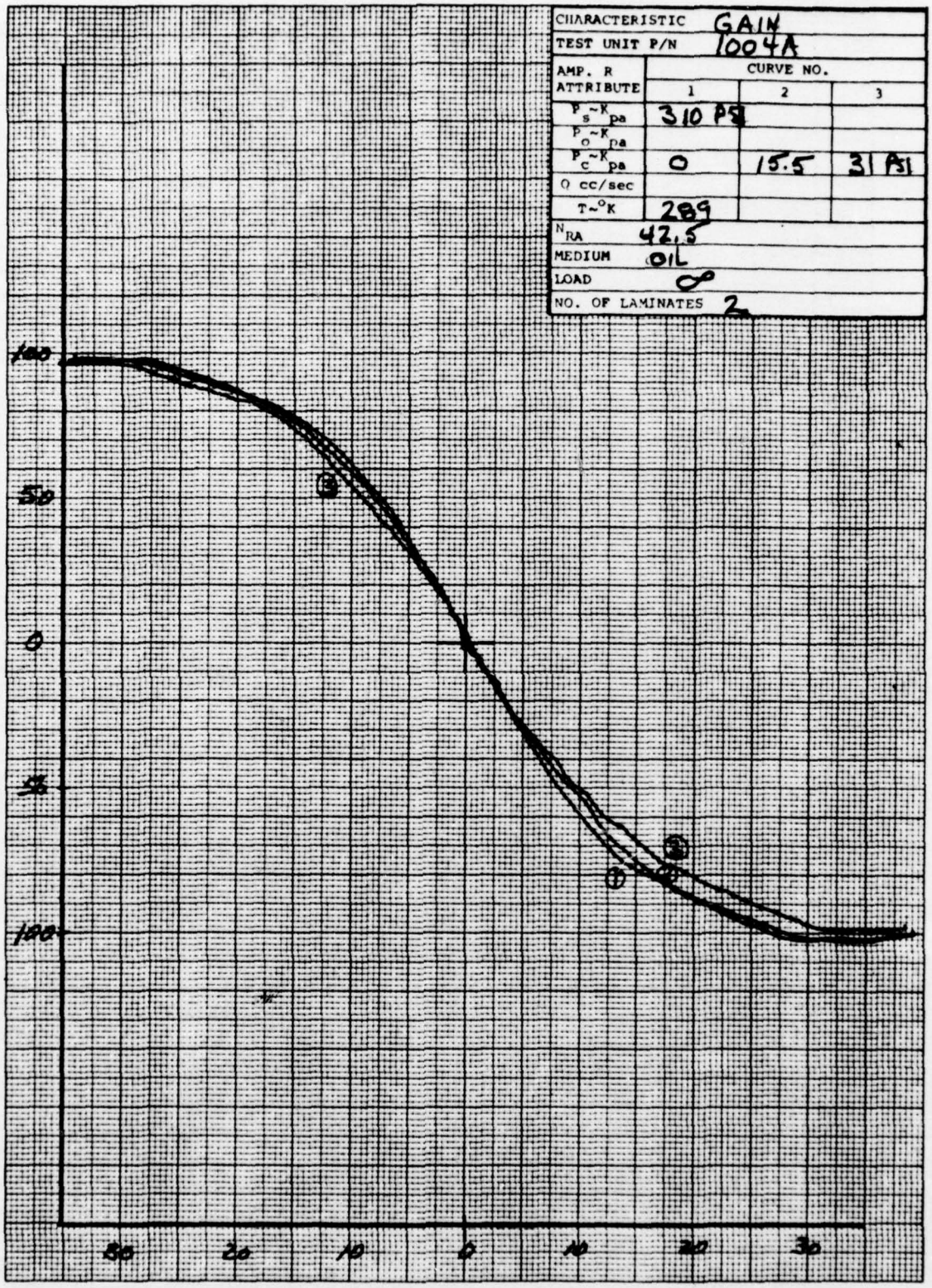


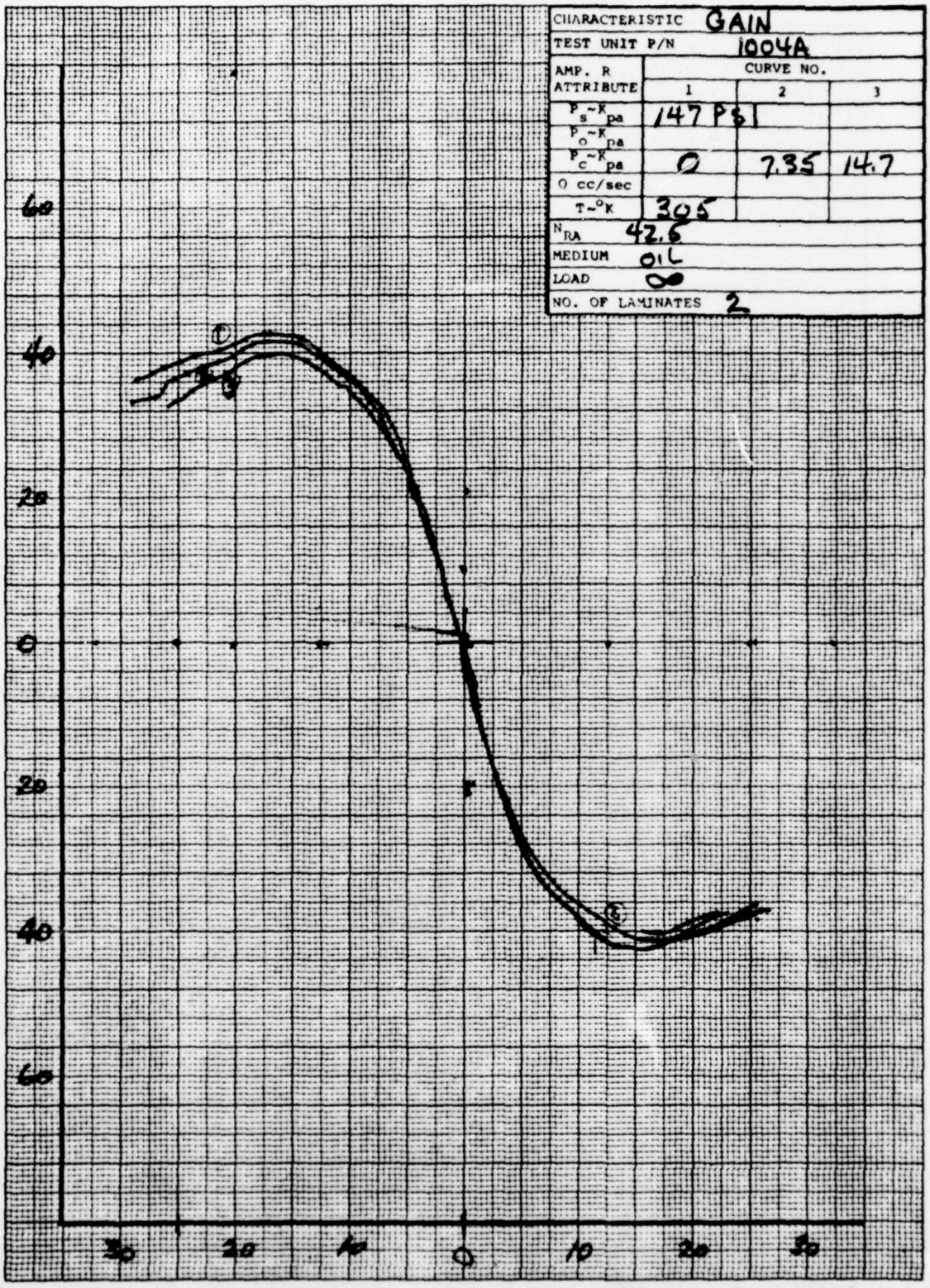


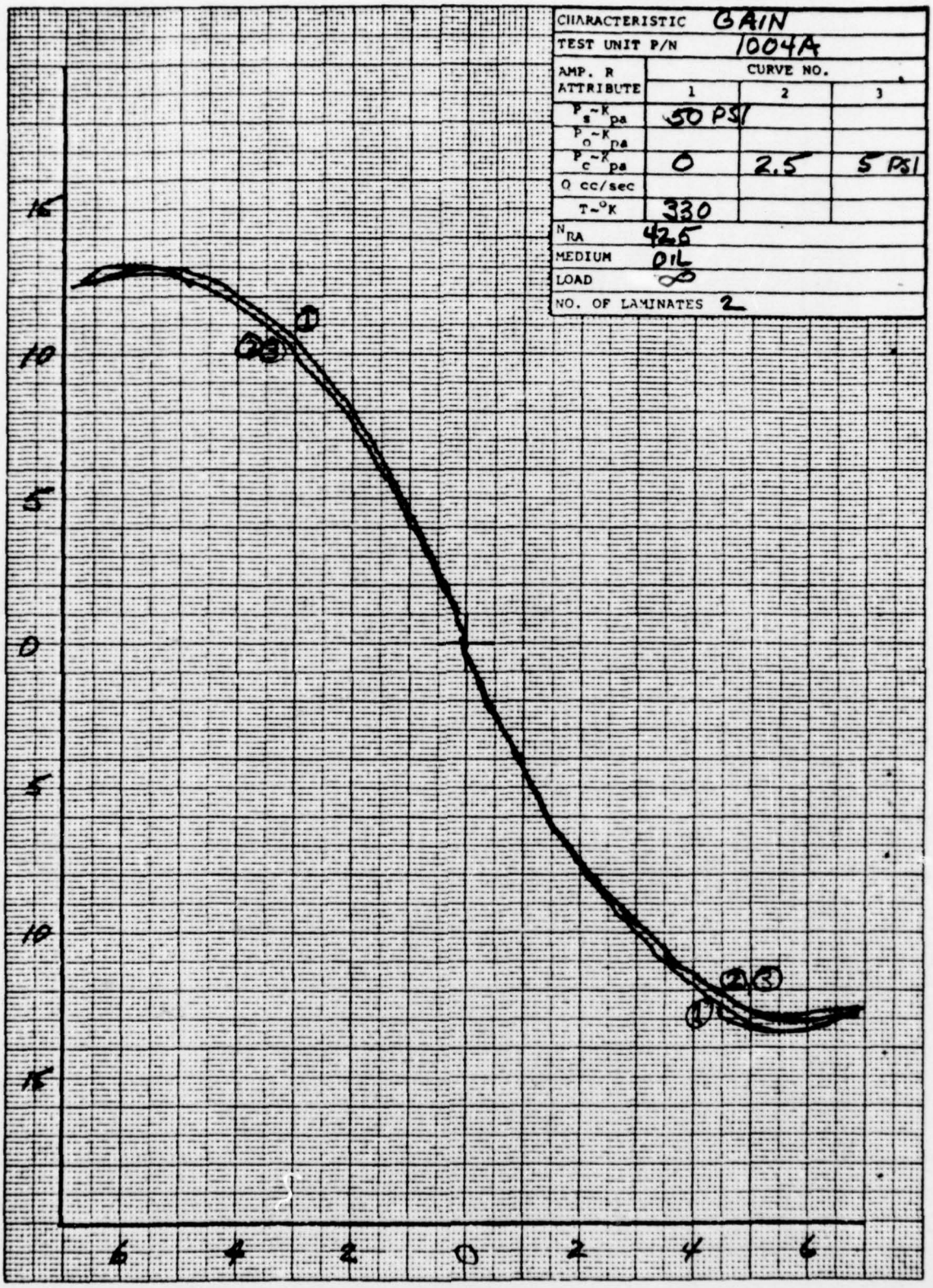

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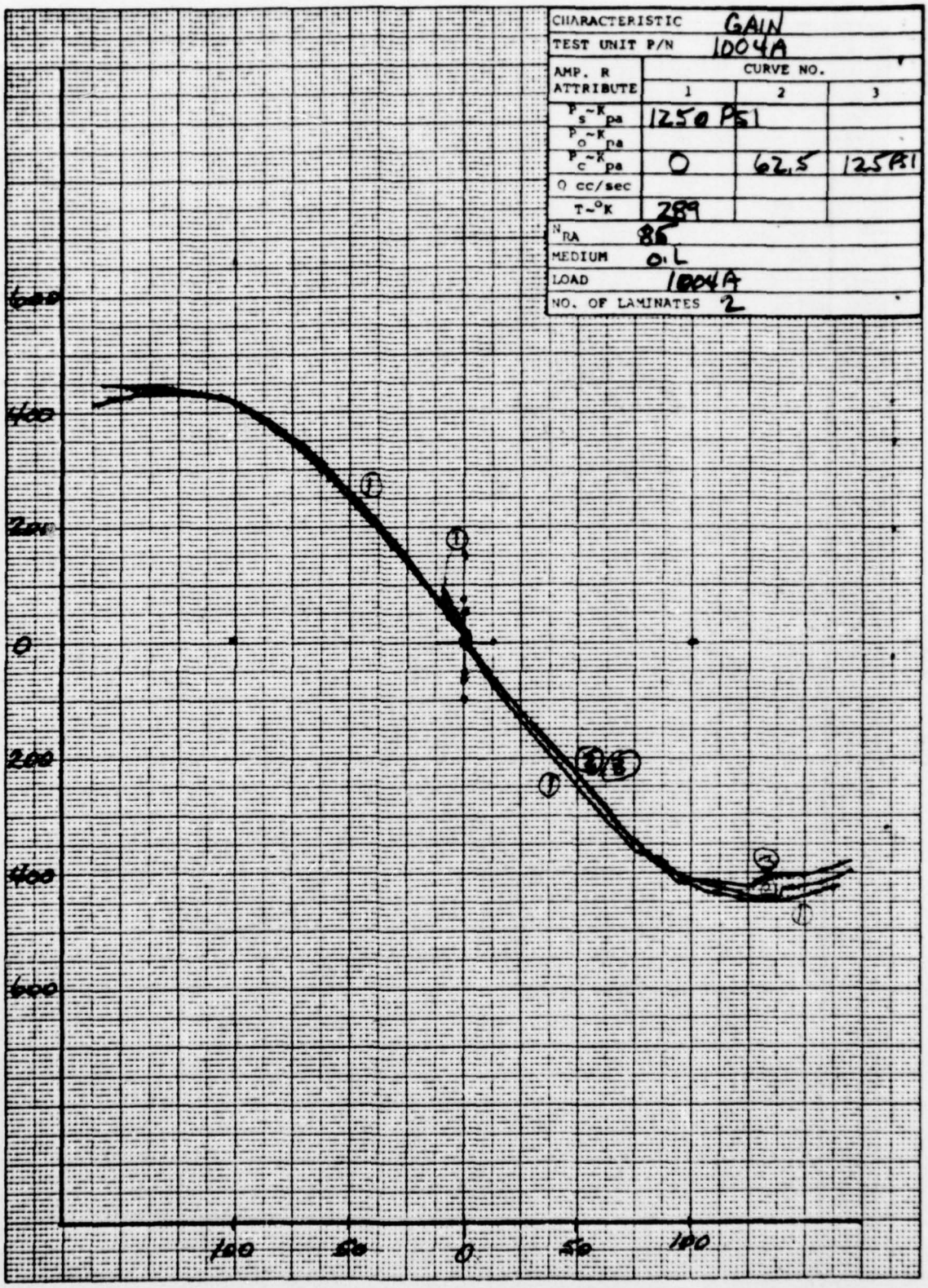

CHARACTERISTIC GAIN
TEST UNIT P/N 1004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
580 PSI
$P_o$~K pa
$P_c$~K pa
0
29
58
Q cc/sec
T~°K
305°
$N_{RA}$ 85
MEDIUM OIL
LOAD ∞
NO. OF LAMINATES 2
200
100
0
100
200
300
120
80
40
0
40
80
120
$\Delta P_o$, PSI
$\Delta P_c$, PSI

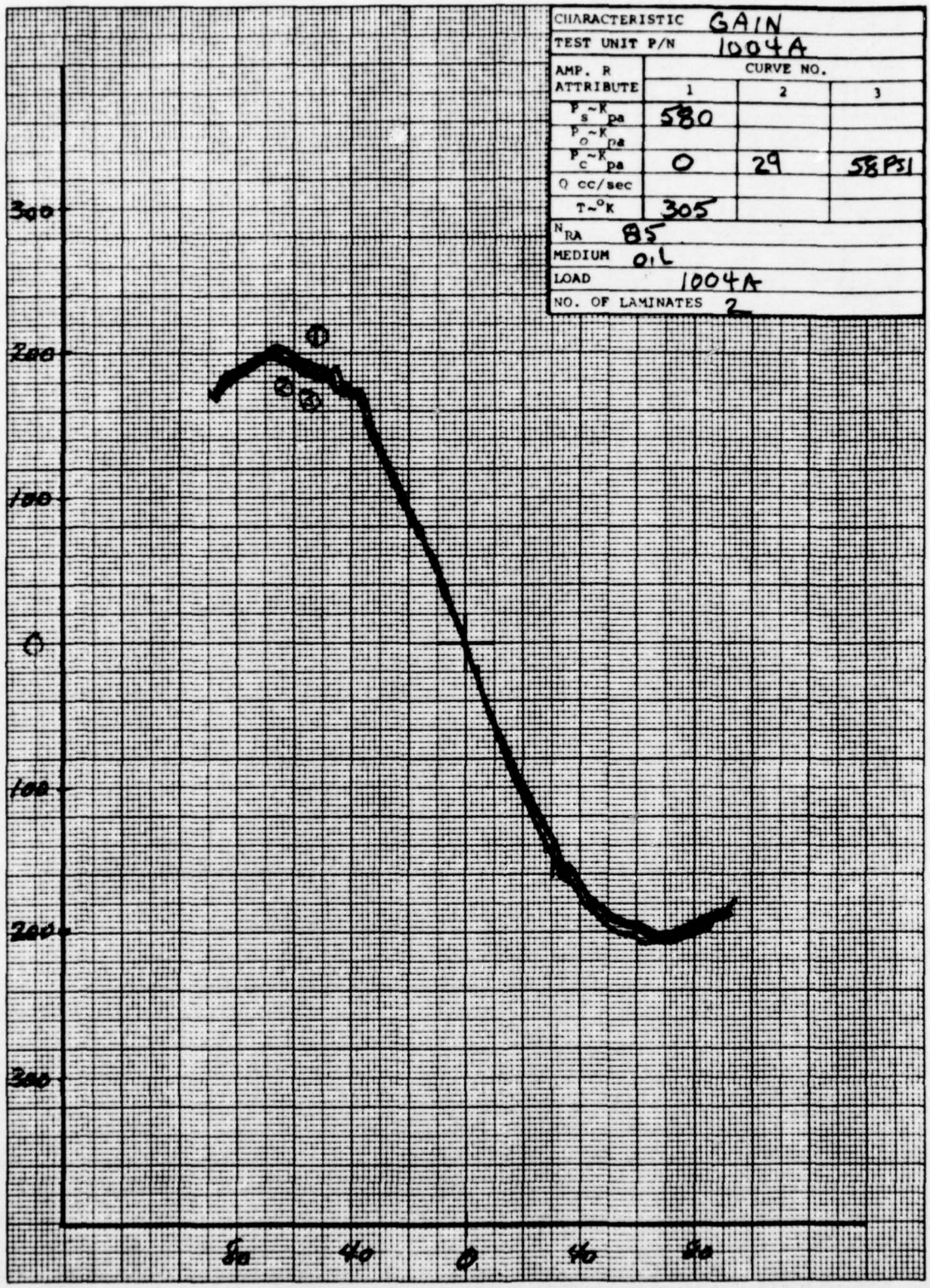

CHARACTERISTIC GAIN
TEST UNIT P/N 1004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa 200 PSI
$P_o$~Kpa
$P_c$~Kpa 0 10 20PSI
Q cc/sec
T~°K 330
$N_{RA}$ 86
MEDIUM OIL
LOAD
NO. OF LAMINATES 2
100
0
100
30
20
10
0
10
20
30
ΔP, psi
ΔPc, psi

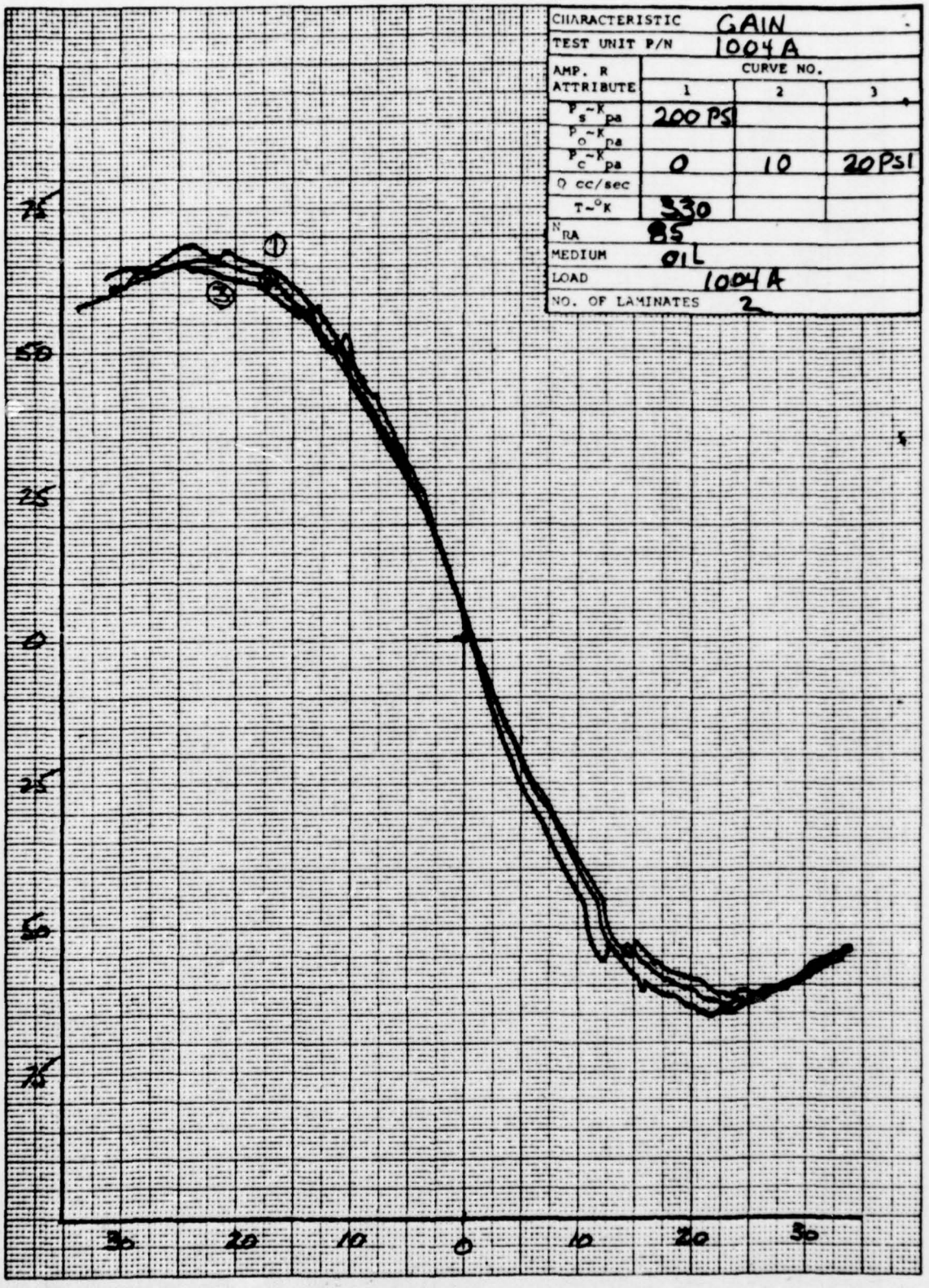

CHARACTERISTIC GAIN
TEST UNIT P/N 1004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
310 PSI
$P_o$~K pa
$P_c$~K pa
0
15.5
31 PSI
Q cc/sec
T~°K
289
$N_{RA}$
42,5
MEDIUM
OIL
LOAD
∞
NO. OF LAMINATES
2
100
50
0
50
100
30
20
10
0
10
20
30
$\Delta P_o$, PSI
$\Delta P_c$, PSI

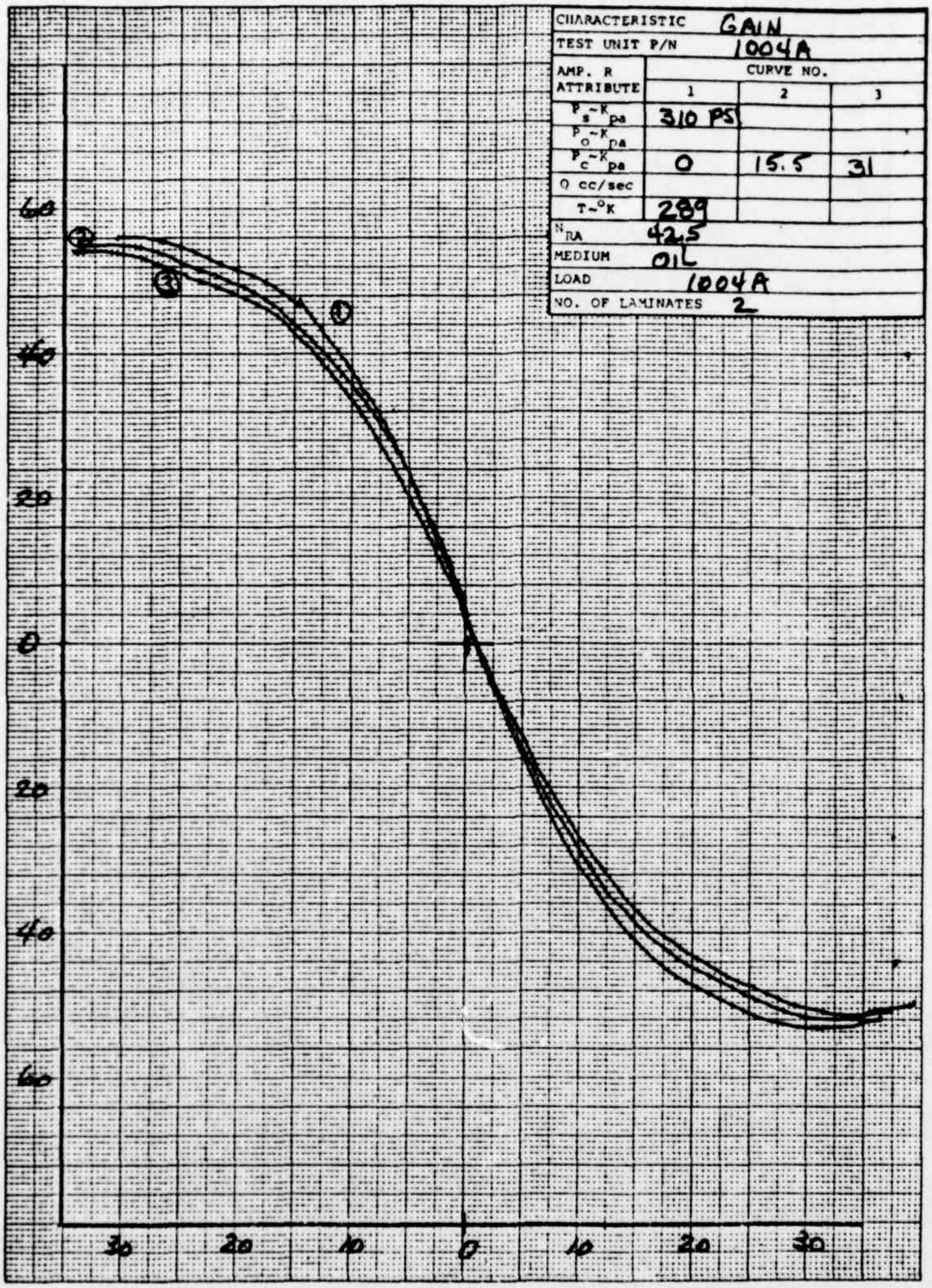

CHARACTERISTIC GAIN
TEST UNIT P/N 1004A
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa 147 PSI
$P_o$~K pa
$P_c$~K pa 0 7.35 14.7
Q cc/sec
T~°K 305
$N_{RA}$ 42.6
MEDIUM OIL
LOAD ∞
NO. OF LAMINATES 2
60
40
20
0
20
40
60
30
20
10
0
10
20
30
ΔP_o, PSI
ΔP_c, PSI

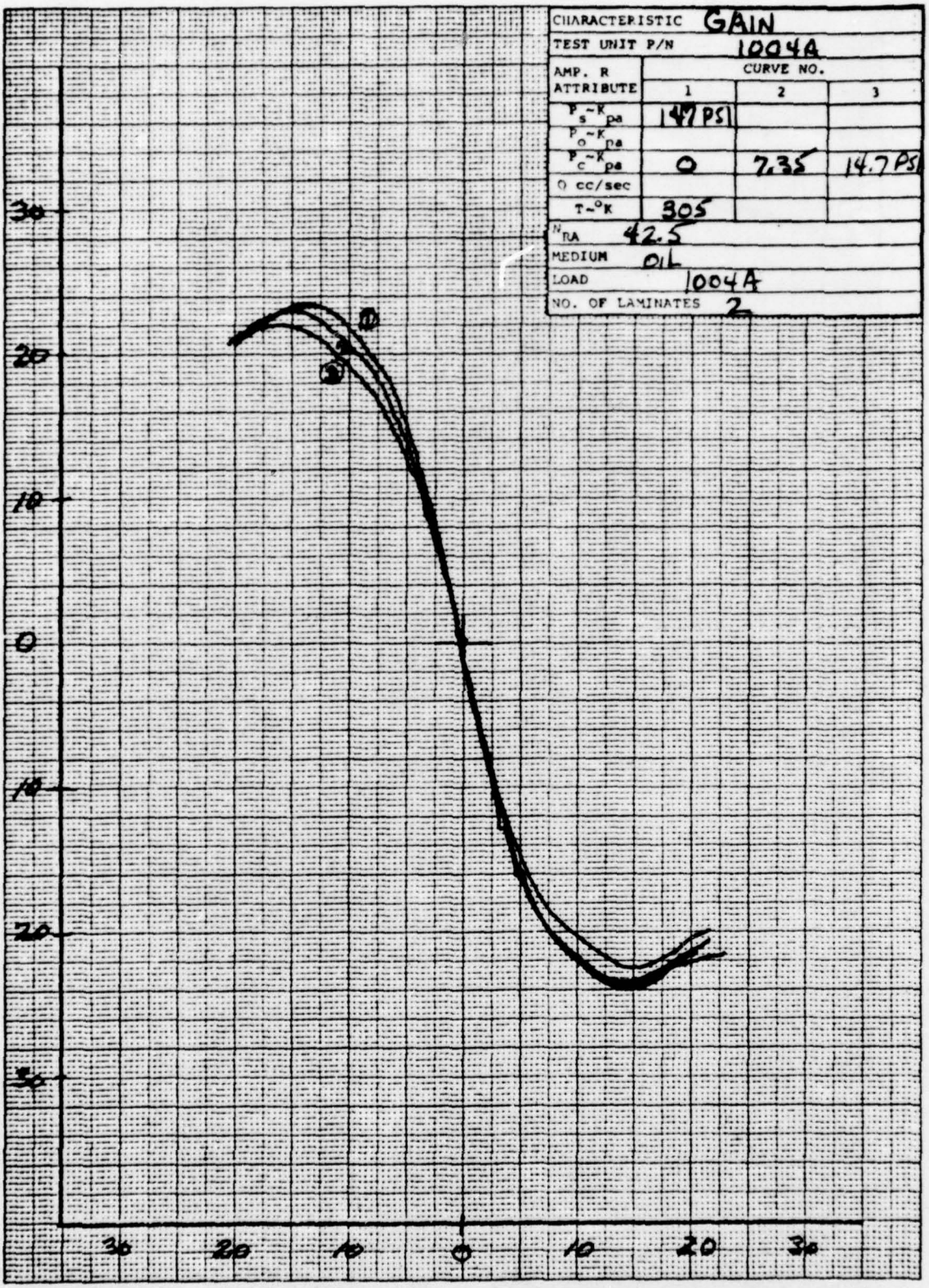

CHARACTERISTIC GAIN
TEST UNIT P/N 1004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa 50 PSI
$P_o$~Kpa
$P_c$~Kpa 0 2.5 5 PSI
Q cc/sec
T~°K 330
$N_{RA}$ 425
MEDIUM OIL
LOAD ∞
NO. OF LAMINATES 2
15
10
5
0
5
10
15
6
4
2
0
2
4
6
ΔPb, PSI
ΔPc, PSI

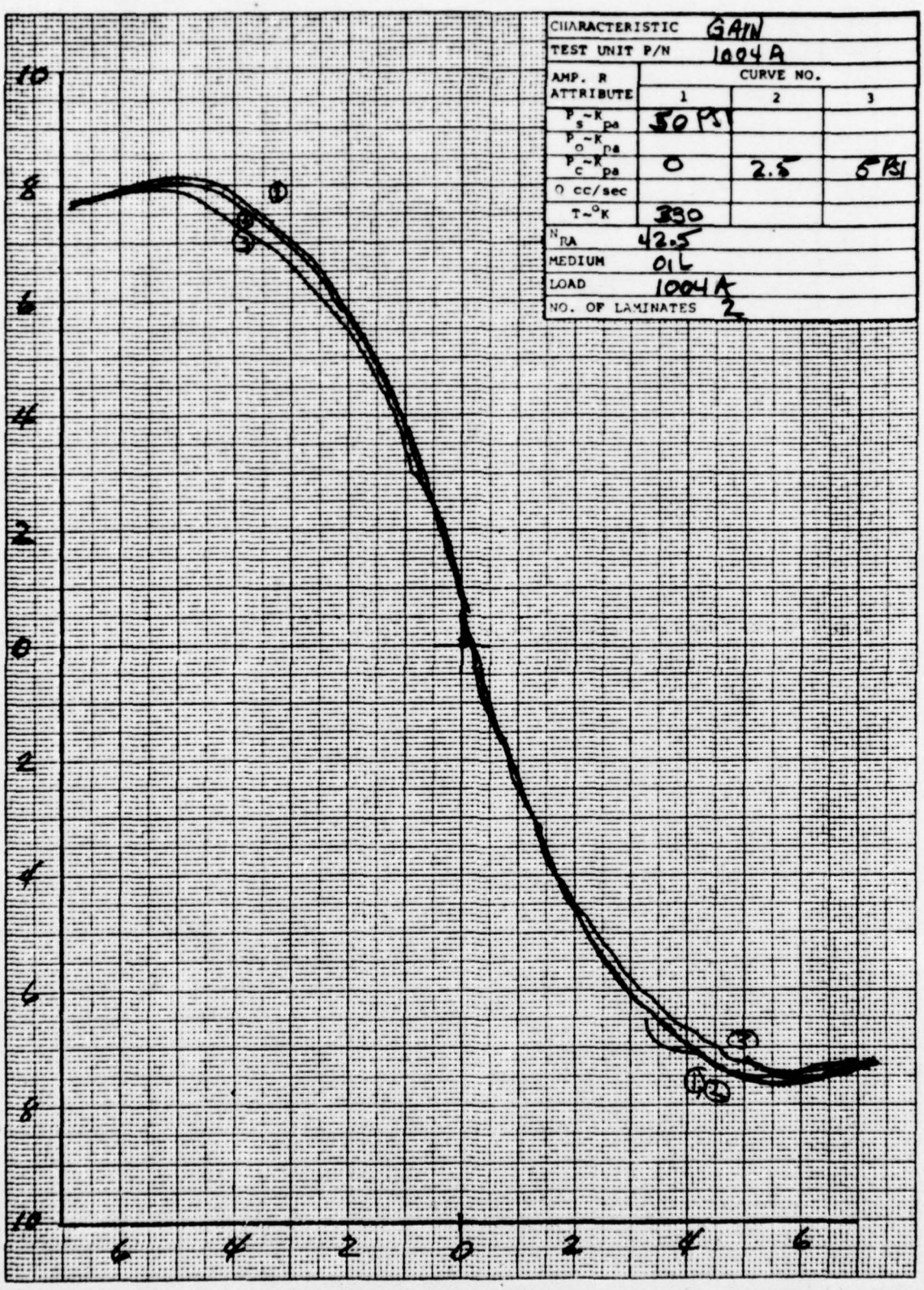

CHARACTERISTIC GAIN
TEST UNIT P/N 1004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s \sim K_{pa}$ 1250 PSI
$P_o \sim K_{pa}$
$P_c \sim K_{pa}$ 0 62.5 125 PSI
Q cc/sec
$T \sim {}^\circ K$ 289
$N_{RA}$ 85
MEDIUM OIL
LOAD 1004A
NO. OF LAMINATES 2
600
400
200
0
200
400
600
100
50
0
50
100
$\Delta P_o$, PSI
$\Delta P_c$, PSI

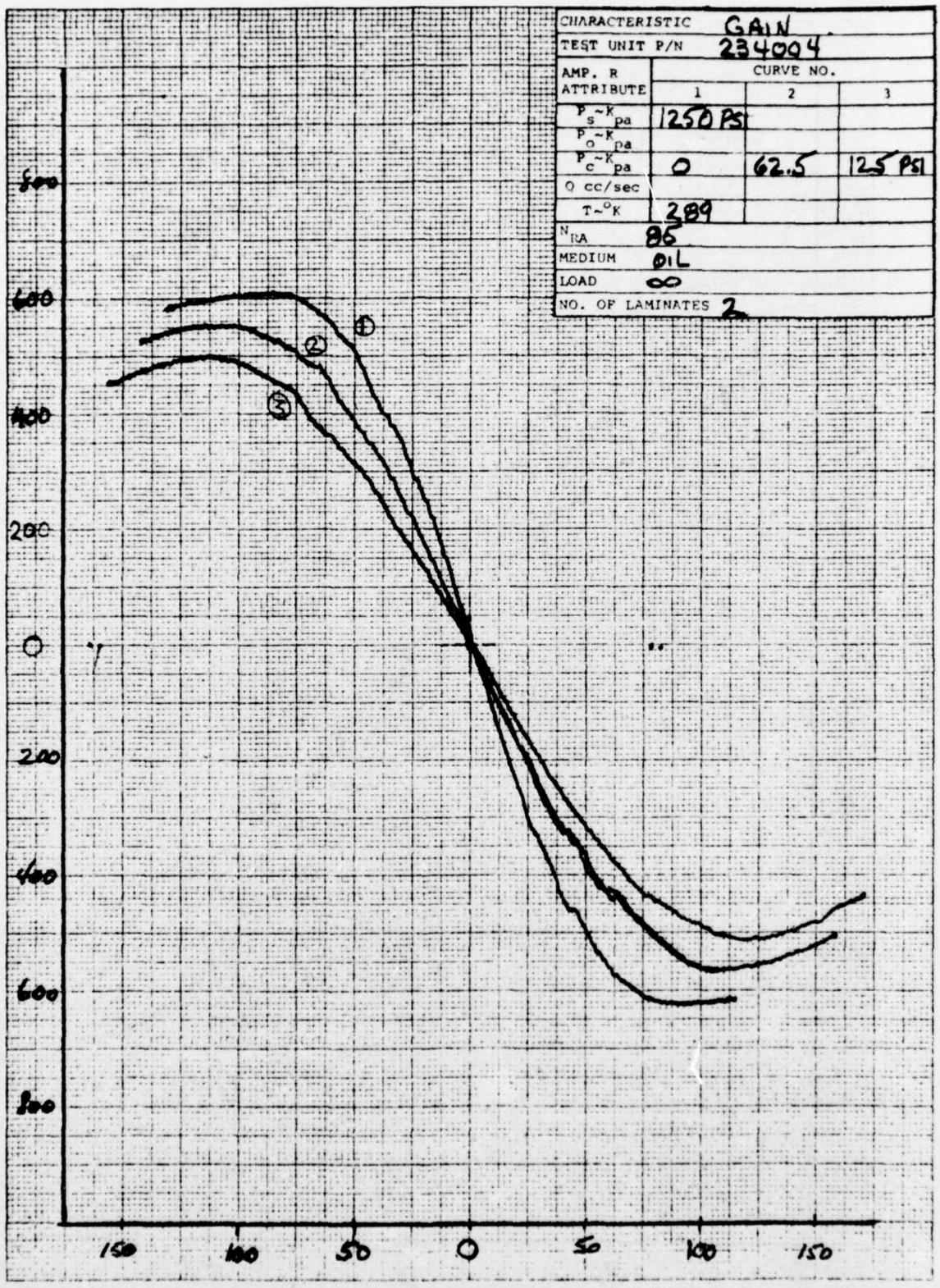

CHARACTERISTIC GAIN
TEST UNIT P/N 1004A
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$ ~K pa 580
$P_o$ ~K pa
$P_c$ ~K pa 0 29 58 PSI
Q cc/sec
T ~°K 305
$N_{RA}$ 85
MEDIUM OIL
LOAD 1004A
NO. OF LAMINATES 2
300
200
100
0
100
200
300
40
0
40
80
$\Delta P_o$, PSI
$\Delta P_c$, PSI

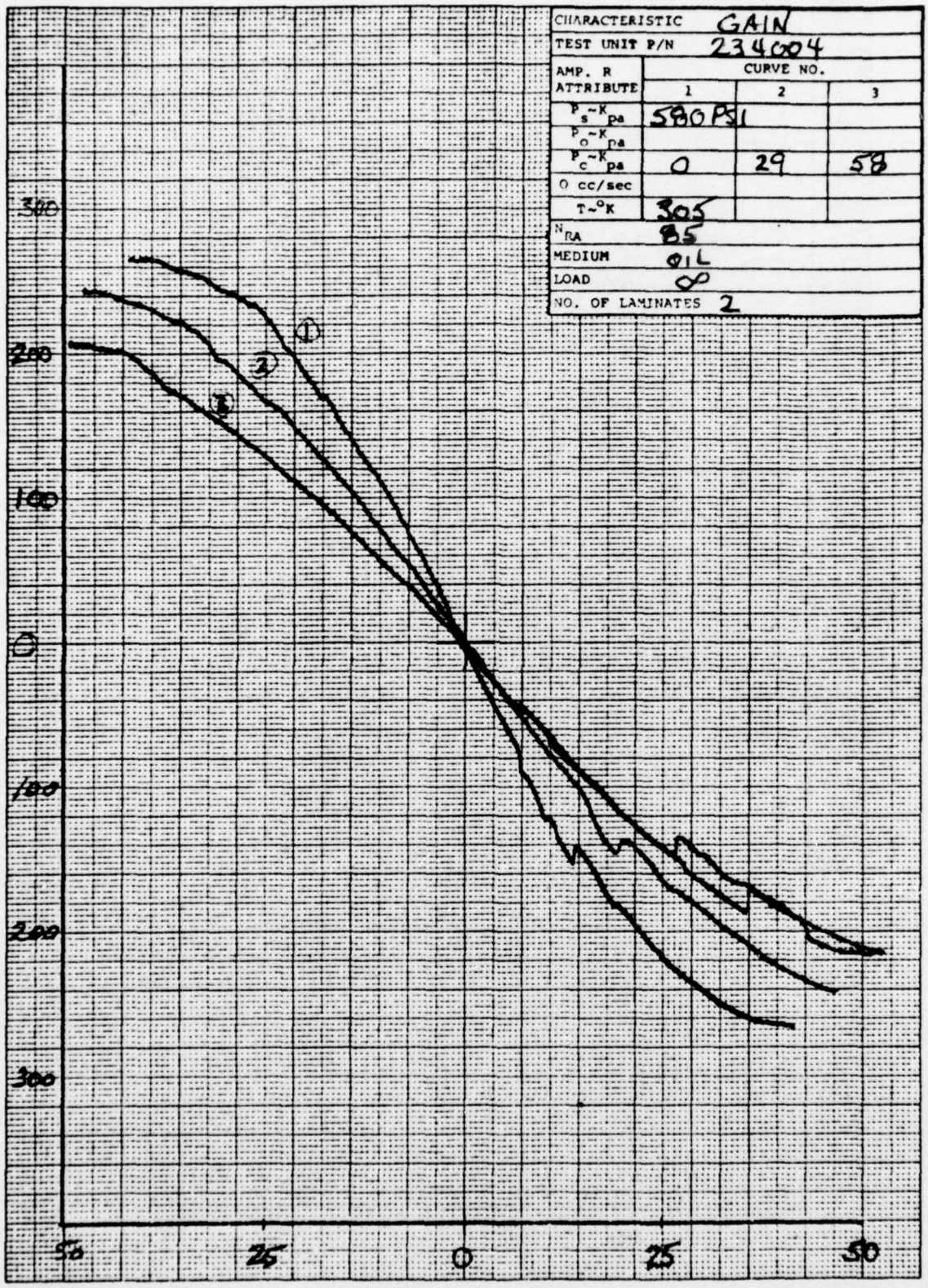

CHARACTERISTIC GAIN
TEST UNIT P/N 1004A
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa 200 PSI
$P_o$~K pa
$P_c$~K pa 0 10 20 PSI
0 cc/sec
T~°K 530
$N_{RA}$ 85
MEDIUM OIL
LOAD 1004A
NO. OF LAMINATES 2
75
50
25
0
25
50
75
30
20
10
0
10
20
30
$\Delta P_o$, psi
$\Delta P_c$, psi

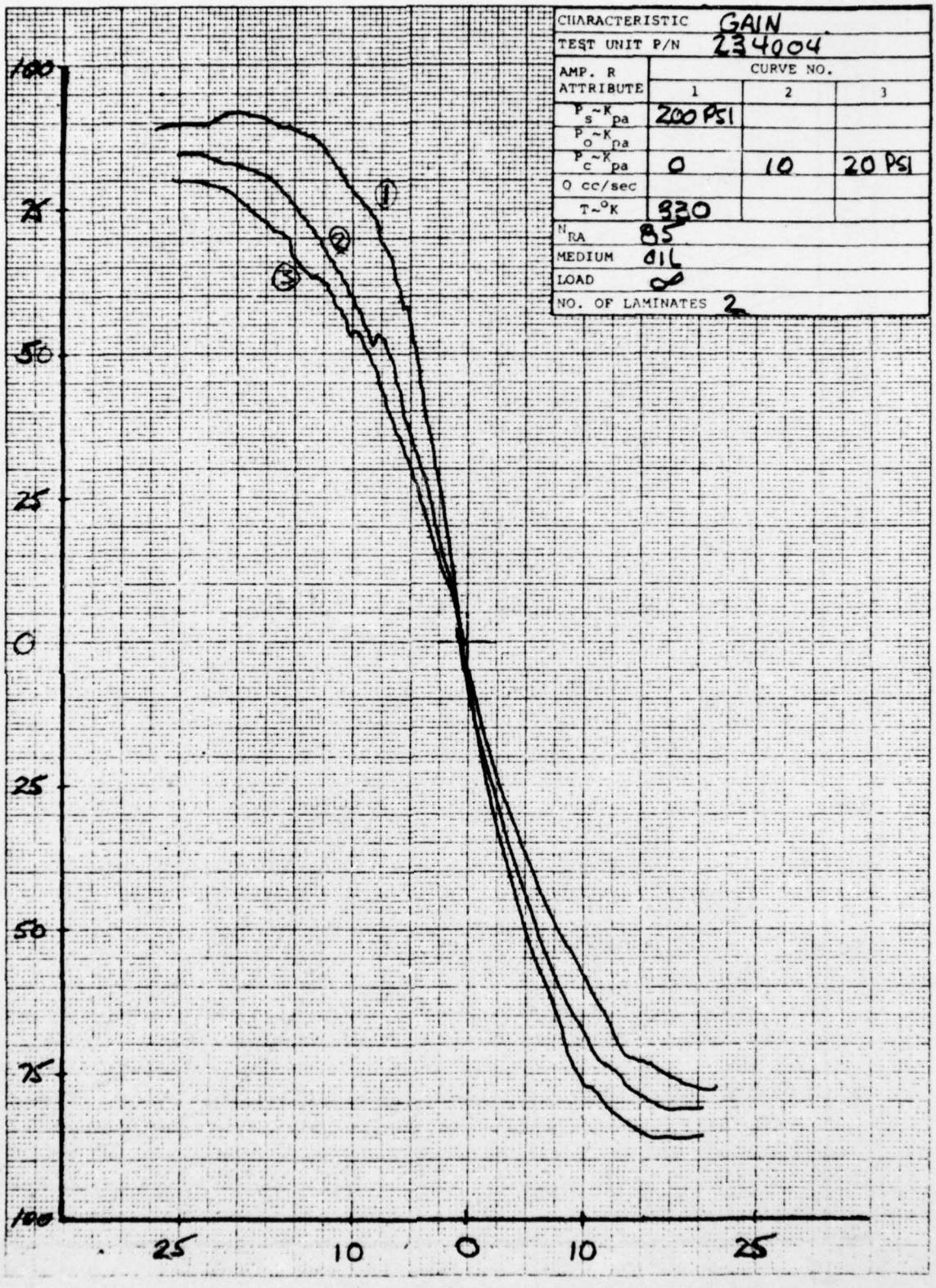

CHARACTERISTIC GAIN
TEST UNIT P/N 1004A
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa 310 PSI
$P_o$~K pa
$P_c$~K pa 0 15.5 31
Q cc/sec
T~°K 289
$N_{RA}$ 425
MEDIUM OIL
LOAD 1004A
NO. OF LAMINATES 2
60
40
20
0
20
40
60
30 20 10 0 10 20 30
$\Delta P_o$, PSI
$\Delta P_c$, PSI

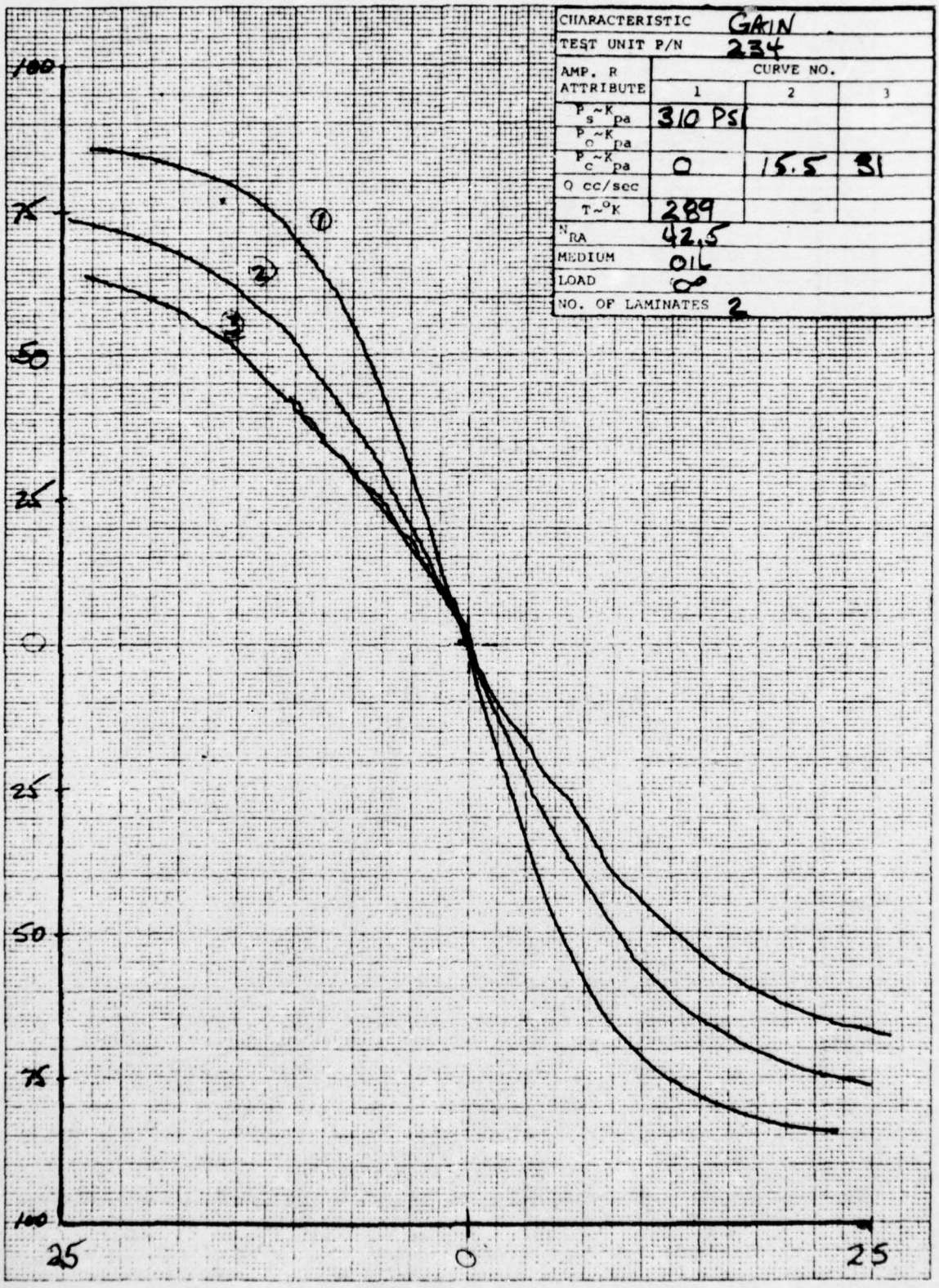

CHARACTERISTIC GAIN
TEST UNIT P/N 1004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
147 PSI
$P_o$~K pa
$P_c$~K pa
0
7.35
14.7 PSI
Q cc/sec
T~°K
305
$N_{RA}$ 42.5
MEDIUM OIL
LOAD 1004A
NO. OF LAMINATES 2
30
20
10
0
10
20
30
30
20
10
0
10
20
30
$\Delta P_o$, PSI
$\Delta P_c$, PSI

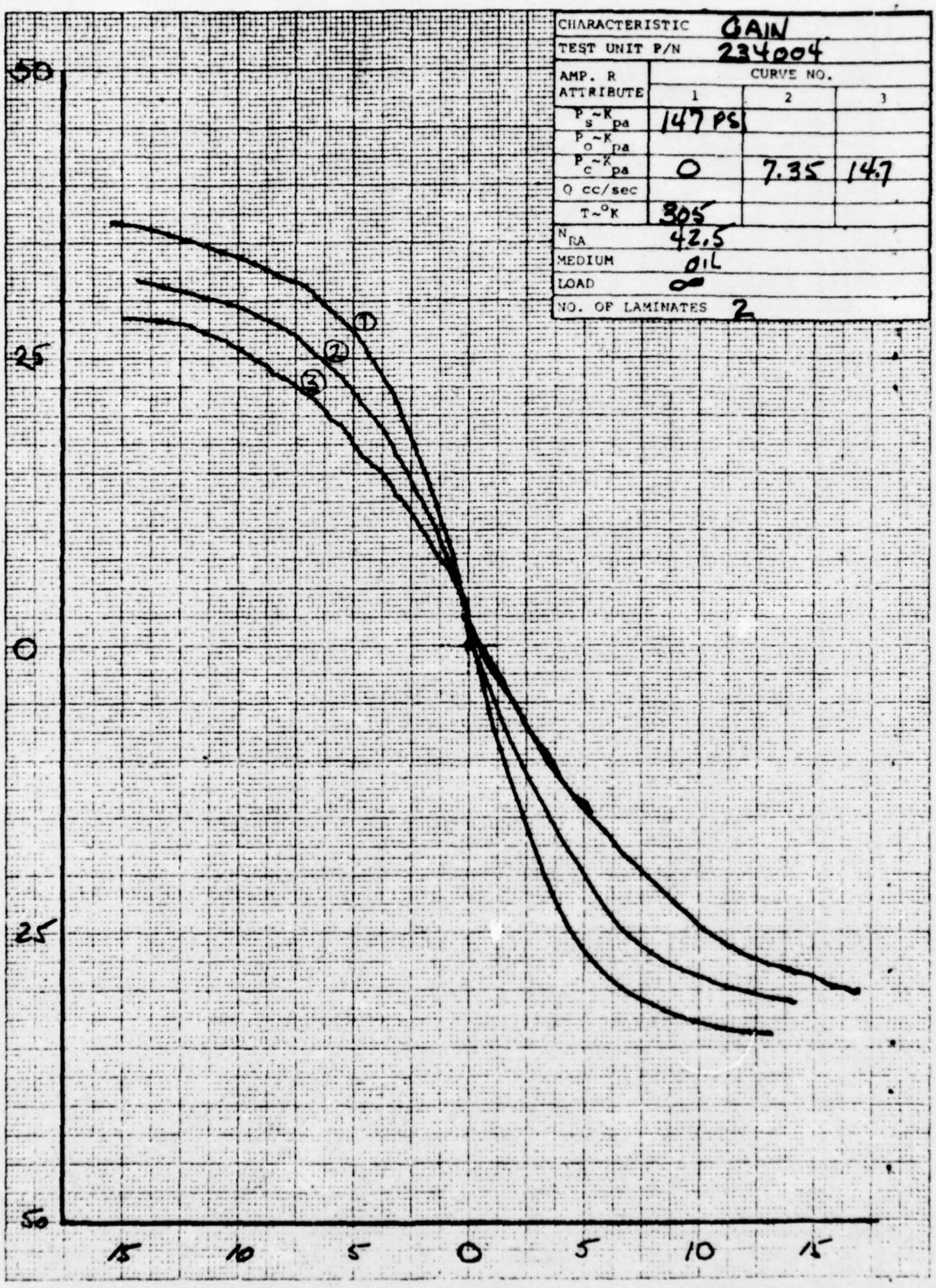

CHARACTERISTIC GAIN
TEST UNIT P/N 1004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~ $K_{ps}$ 50 PSI
$P_o$ ~ $K_{ps}$
$P_c$ ~ $K_{ps}$ 0 2.5 5 PSI
Q cc/sec
T ~ °K 390
$N_{RA}$ 42.5
MEDIUM OIL
LOAD 1004A
NO. OF LAMINATES 2
10
8
6
4
2
0
2
4
6
$\Delta P_o$, PSI
$\Delta P_c$, PSI

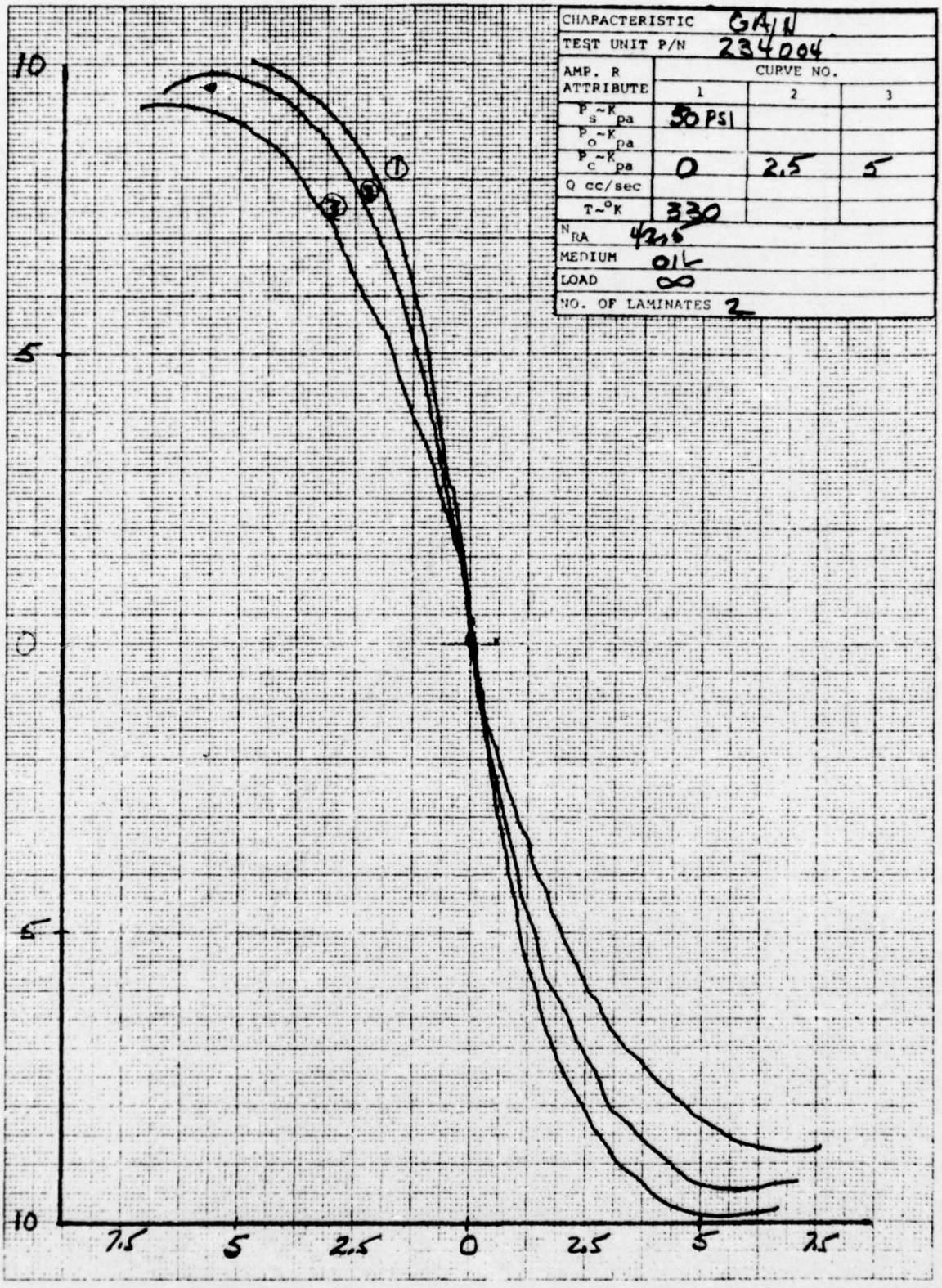

CHARACTERISTIC GAIN
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s \sim K_{pa}$ 1250 PSI
$P_o \sim K_{pa}$
$P_c \sim K_{pa}$ 0 62.5 125 PSI
Q cc/sec
$T \sim {}^oK$ 389
$N_{RA}$ 86
MEDIUM OIL
LOAD ∞
NO. OF LAMINATES 2
800
600
400
200
0
200
400
600
800
150
100
50
0
50
100
150
$\Delta P_o$, PSI
$\Delta P_c$, PSI

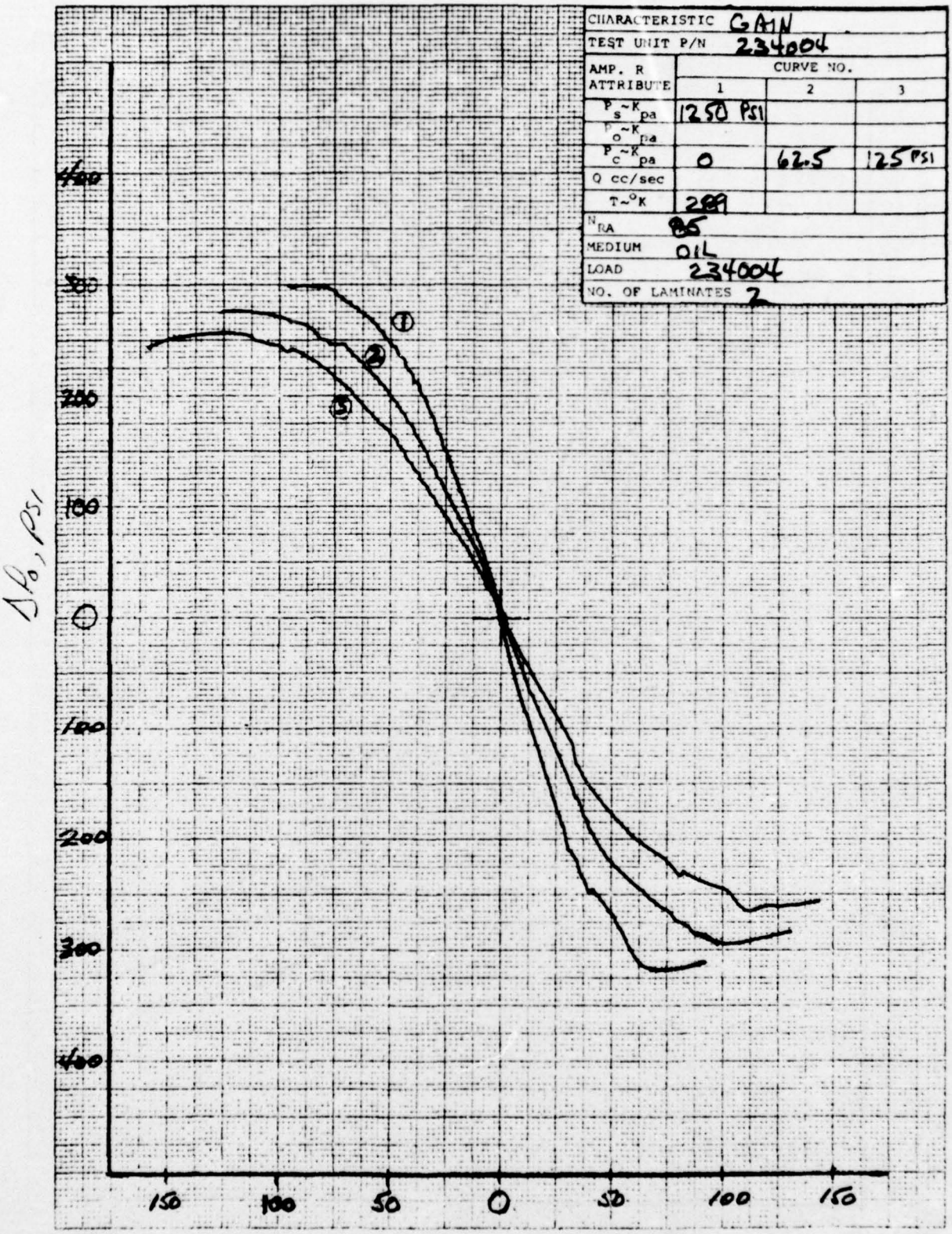

CHARACTERISTIC GAIN
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
580 PSI
$P_o$~K pa
$P_c$~K pa
0
29
58
Q cc/sec
T~°K
305
$N_{RA}$
85
MEDIUM
OIL
LOAD
∞
NO. OF LAMINATES
2
300
200
100
0
100
200
300
50
25
0
25
50
ΔPo, psi
ΔPc, psi

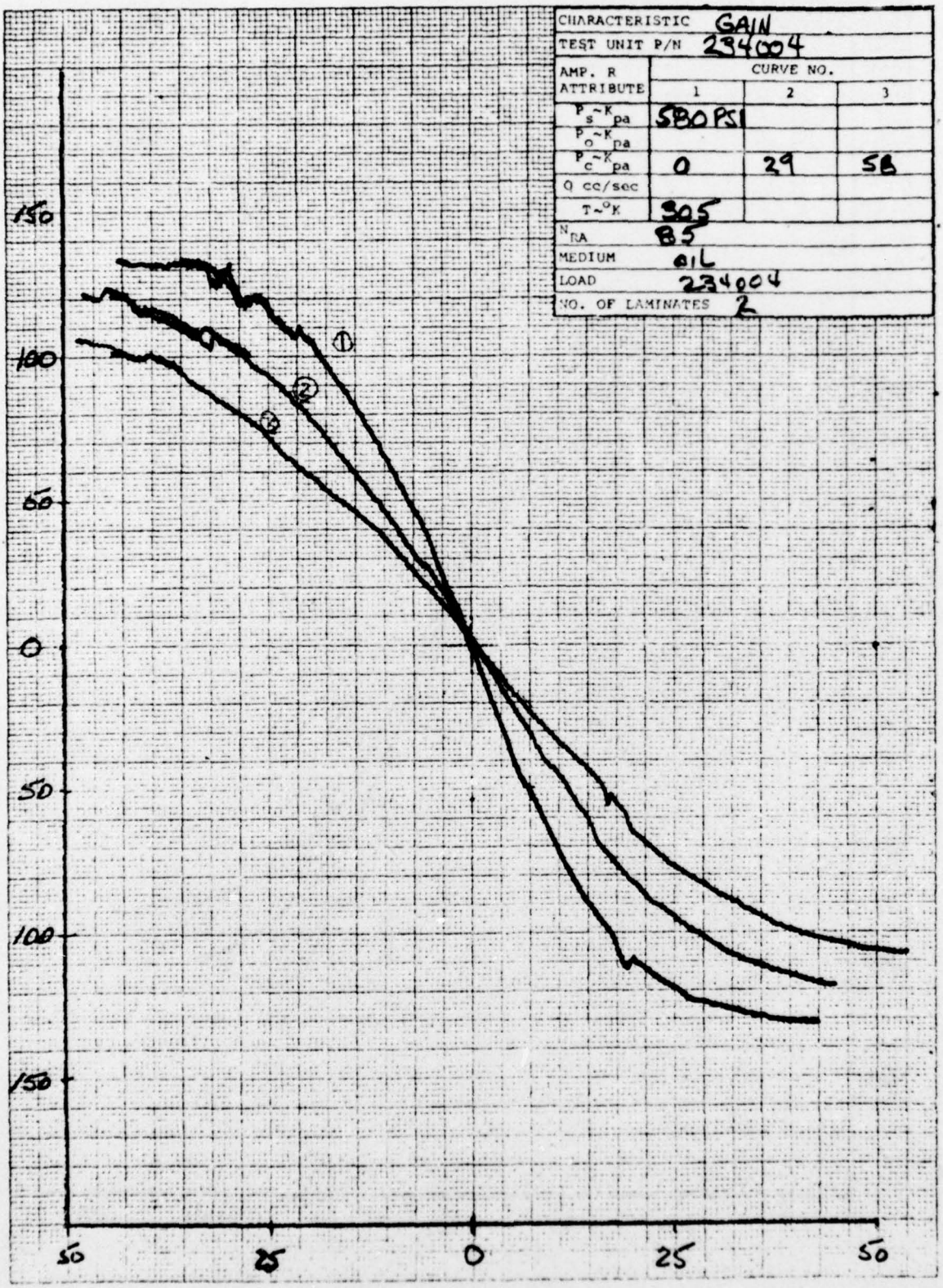

CHARACTERISTIC GAIN
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa 200 PSI
$P_o$~K pa
$P_c$~K pa 0 10 20 PSI
0 cc/sec
T~°K 530
$N_{RA}$ 85
MEDIUM OIL
LOAD ∞
NO. OF LAMINATES 2
100
75
50
25
0
25
50
75
100
25
10
0
10
25
ΔPs, PSI
ΔPc, PSI

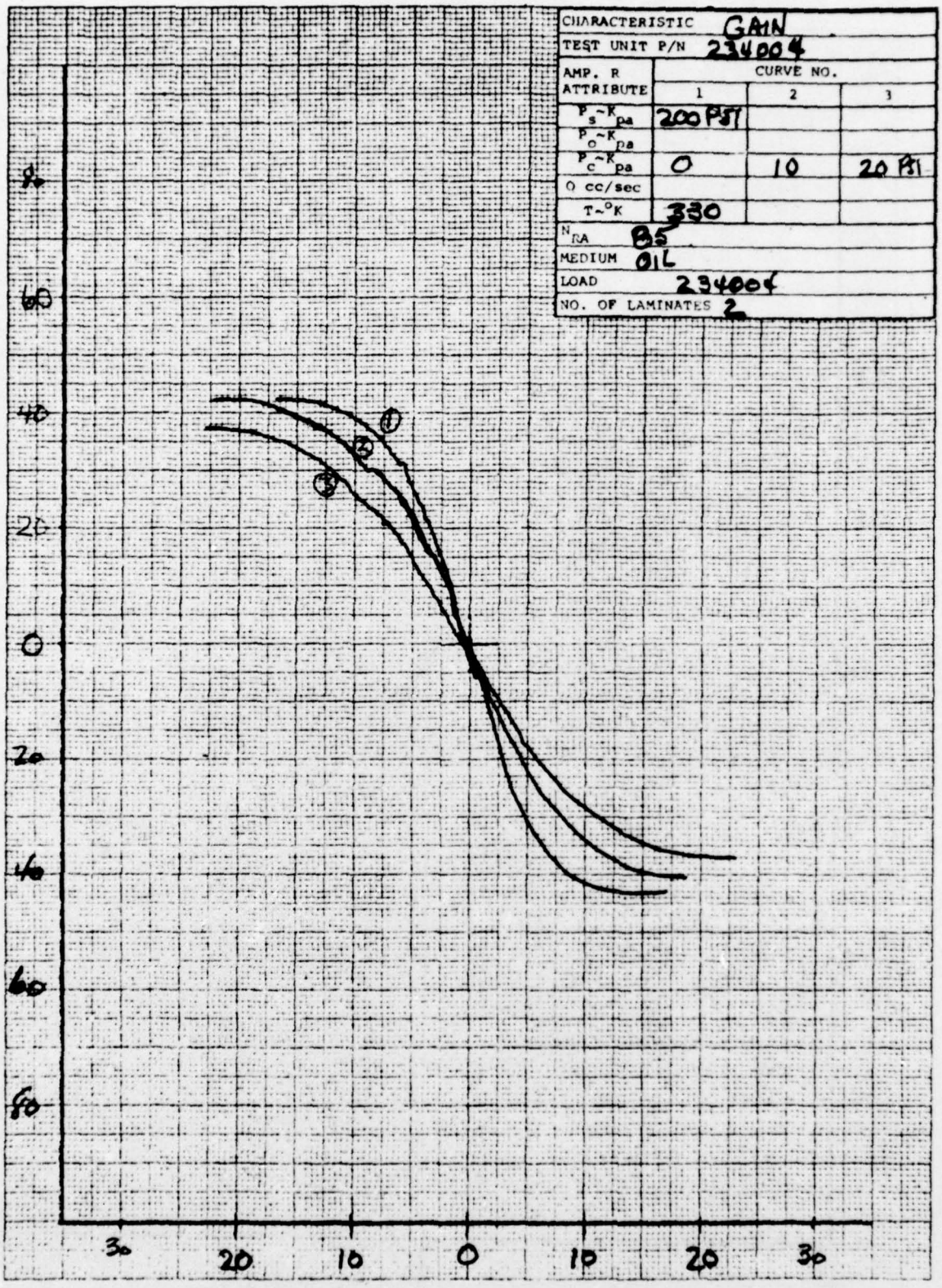

CHARACTERISTIC GAIN
TEST UNIT P/N 234
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~Kpa 310 PSI
$P_o$~Kpa
$P_c$~Kpa 0 15.5 31
Q cc/sec
T~°K 289
$N_{RA}$ 42.5
MEDIUM OIL
LOAD ∞
NO. OF LAMINATES 2
100
75
50
25
0
25
50
75
100
25
0
25
ΔF, PSI
ΔPc, PSI

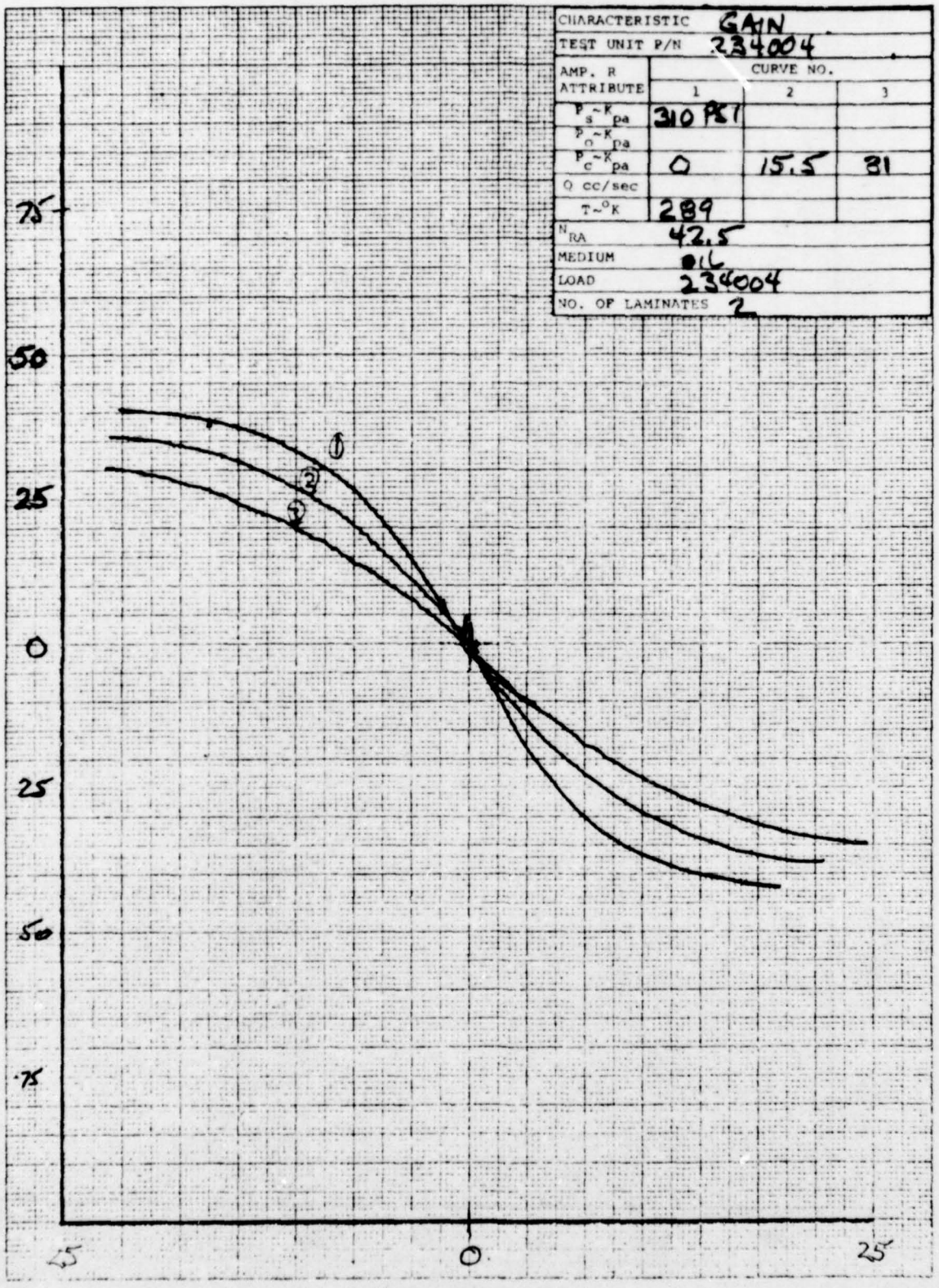

CHARACTERISTIC GAIN
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
147 PSI
$P_o$~K pa
$P_c$~K pa
0
7.35
14.7
Q cc/sec
T~°K
305
$N_{RA}$
42.5
MEDIUM
OIL
LOAD
∞
NO. OF LAMINATES
2
50
25
0
25
50
15
10
5
0
5
10
15
ΔP₀, PSI
ΔPc, PSI

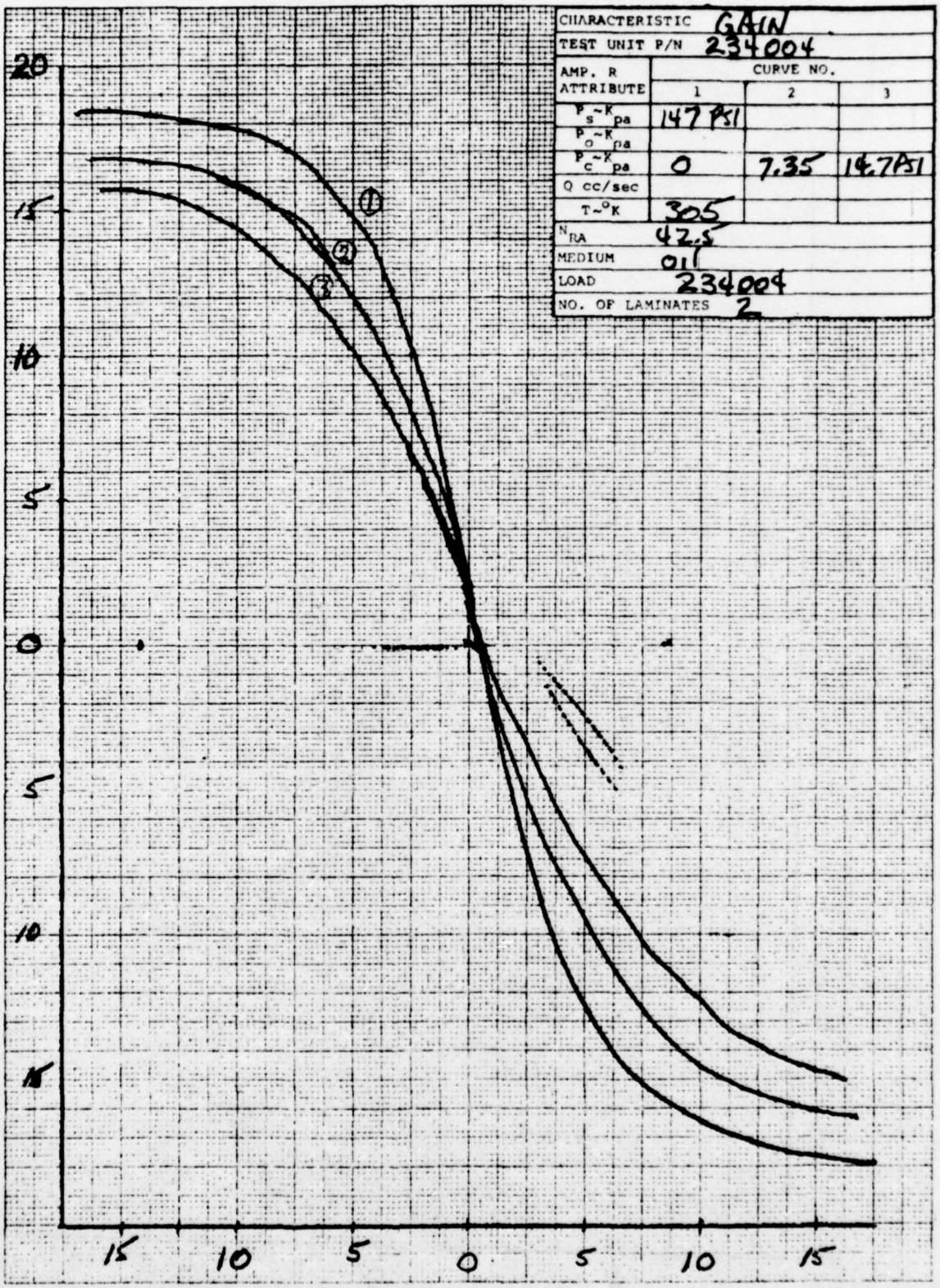

CHARACTERISTIC GAIN
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~K pa
50 PSI
$P_o$ ~K pa
$P_c$ ~K pa
0
2.5
5
Q cc/sec
T~°K
330
$N_{RA}$
4215
MEDIUM
OIL
LOAD
∞
NO. OF LAMINATES
2
10
5
0
5
10
7.5
5
2.5
0
2.5
5
7.5
$\Delta P_o$, psi
$\Delta P_c$, psi

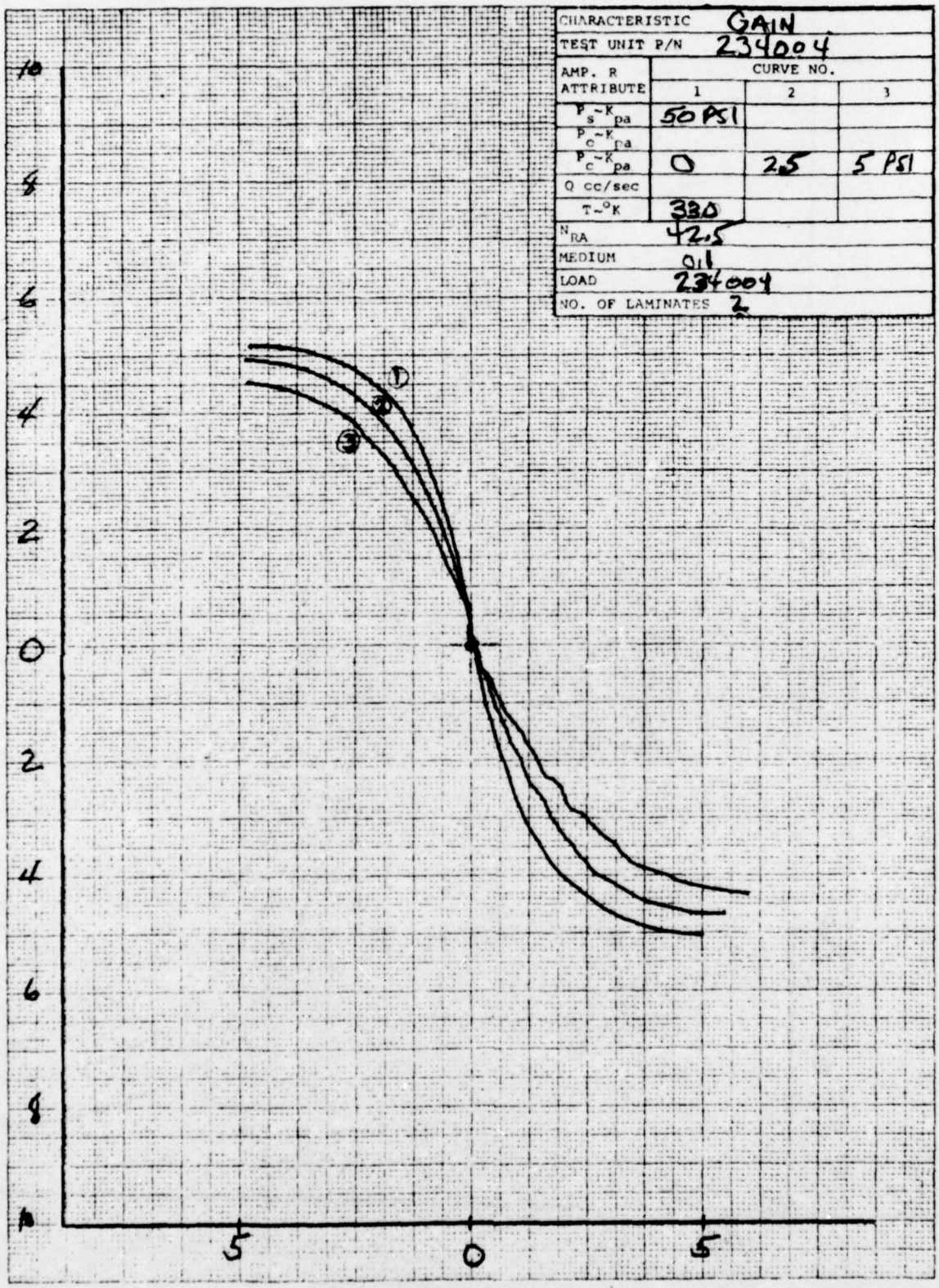

CHARACTERISTIC GAIN
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa 1250 PSI
$P_o$~Kpa
$P_c$~Kpa 0 62.5 125 PSI
Q cc/sec
T~°K 289
$N_{RA}$ 85
MEDIUM OIL
LOAD 234004
NO. OF LAMINATES 2
400
300
200
100
0
100
200
300
400
150
100
50
0
50
100
150
$\Delta P_o$, PSI
$\Delta P_c$, PSI

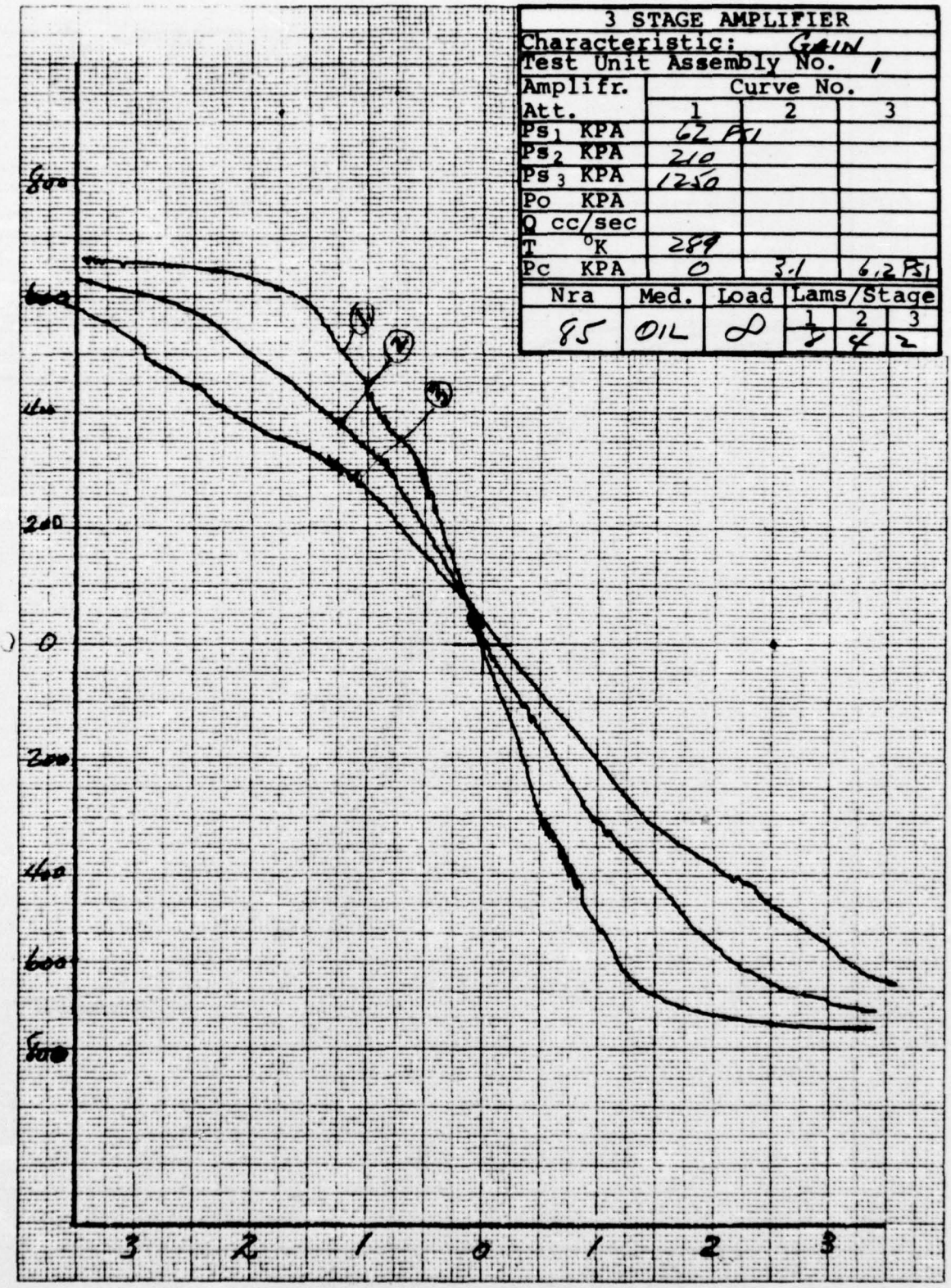

CHARACTERISTIC GAIN
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa 580 PSI
$P_o$~K pa
$P_c$~K pa 0 29 58
Q cc/sec
T~°K 305
$N_{RA}$ B5
MEDIUM OIL
LOAD 234004
NO. OF LAMINATES 2
150
100
50
0
50
100
150
50
25
0
25
50
①
②
③
$\Delta P_o$, PSI
$\Delta P_c$, PSI

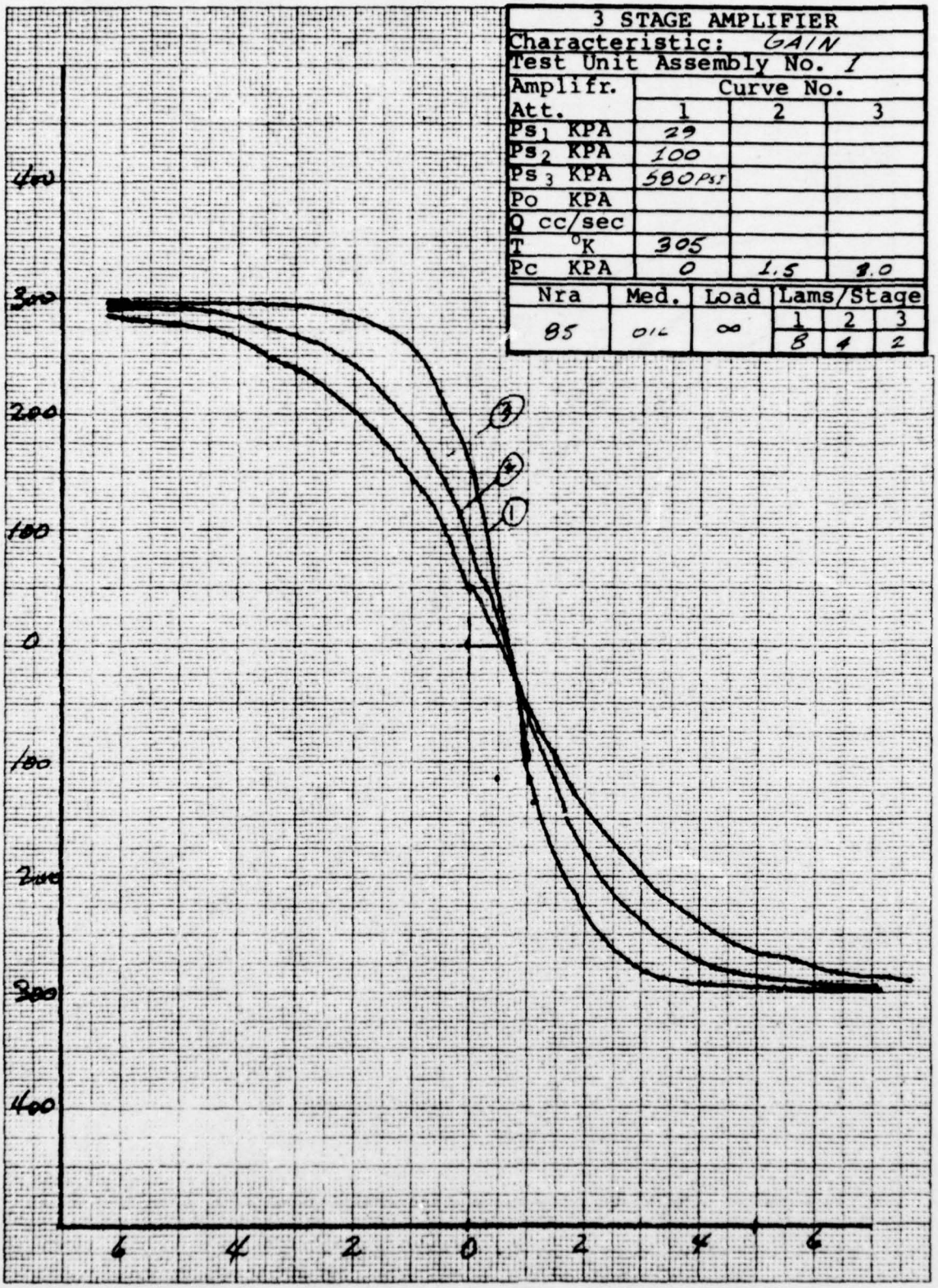

CHARACTERISTIC GAIN
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa 200 PSI
$P_o$~Kpa
$P_c$~Kpa 0 10 20 PSI
Q cc/sec
T~°K 330
$N_{RA}$ 85
MEDIUM OIL
LOAD 234004
NO. OF LAMINATES 2
ΔPs, psi
ΔPc, psi
60
40
20
0
20
40
60
80
30
20
10
0
10
20
30

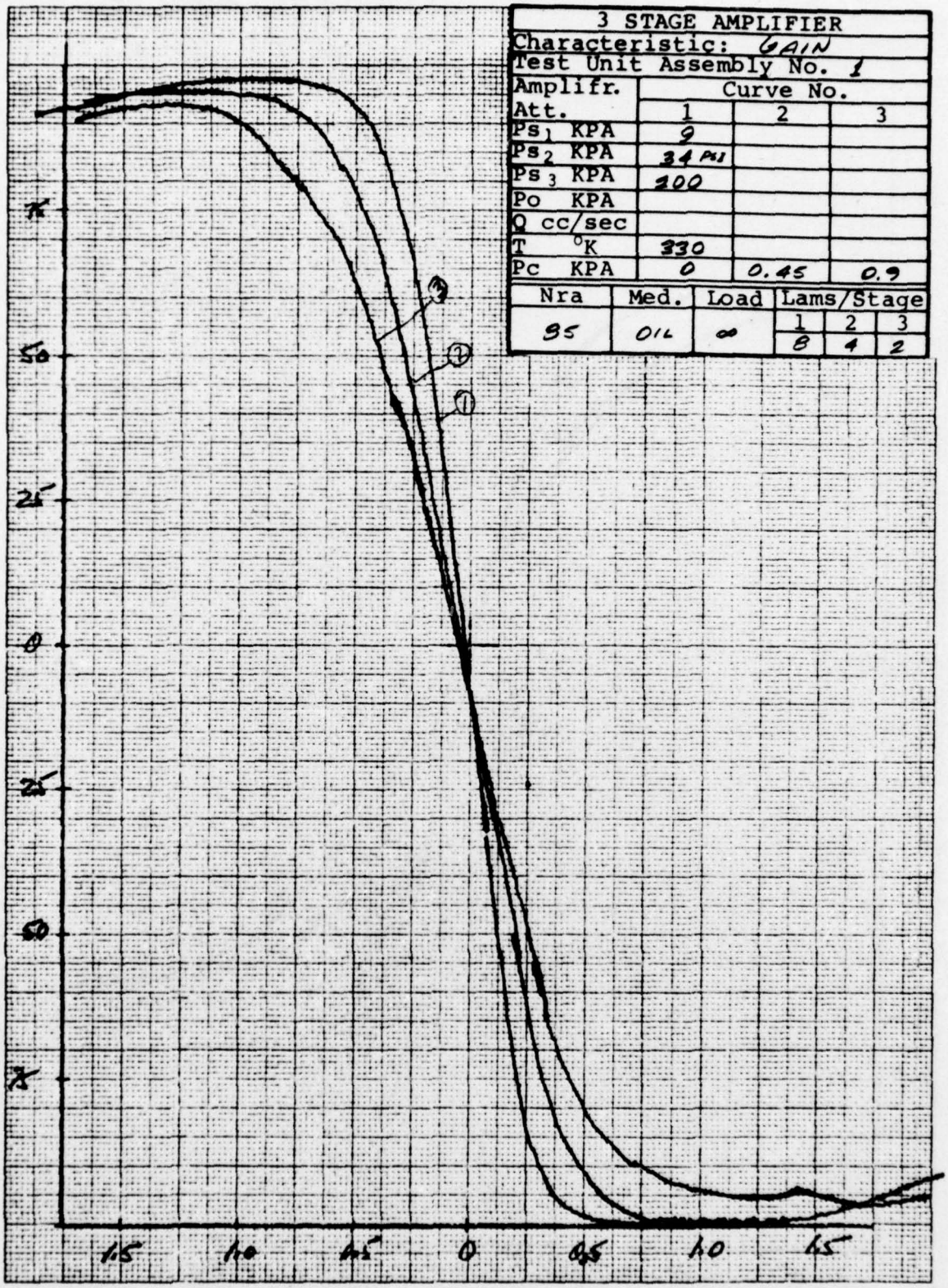

CHARACTERISTIC GAIN
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
310 PSI
$P_o$~K pa
$P_c$~K pa
0
15.5
31
Q cc/sec
T~°K
289
$N_{RA}$
42.5
MEDIUM
OIL
LOAD
234004
NO. OF LAMINATES
2
75
50
25
0
25
50
75
-25
0
25
1
2
3
$\Delta P_s$, psi
$\Delta P_c$, psi


CHARACTERISTIC GAIN
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
147 PSI
$P_o$~K pa
$P_c$~K pa
0
7.35
14.7PSI
Q cc/sec
T~°K
305
$N_{RA}$
42.5
MEDIUM
OIL
LOAD
234004
NO. OF LAMINATES
2
20
15
10
5
0
5
10
15
$\Delta P_o$, PSI
$\Delta P_c$, PSI


CHARACTERISTIC GAIN
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
50 PSI
$P_c$~K pa
$P_c$~K pa
0
2.5
5 PSI
Q cc/sec
T~°K
330
$N_{RA}$
42.5
MEDIUM
oil
LOAD
234004
NO. OF LAMINATES
2
10
8
6
4
2
0
2
4
6
8
10
5
0
5
$\Delta P_s$, psi
$\Delta P_c$, psi


3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 1
Amplifr. Curve No.
Att. 1 2 3
Ps1 KPA 62 PSI
Ps2 KPA 210
Ps3 KPA 1250
Po KPA
Q cc/sec
T °K 289
Pc KPA 0 3.1 6.2 PSI
Nra Med. Load Lams/Stage 1 2 3
85 OIL ∞ 1 4 2
800
600
400
200
0
200
400
600
800
3 2 1 0 1 2 3
LF, PSI
ΔPc, psi

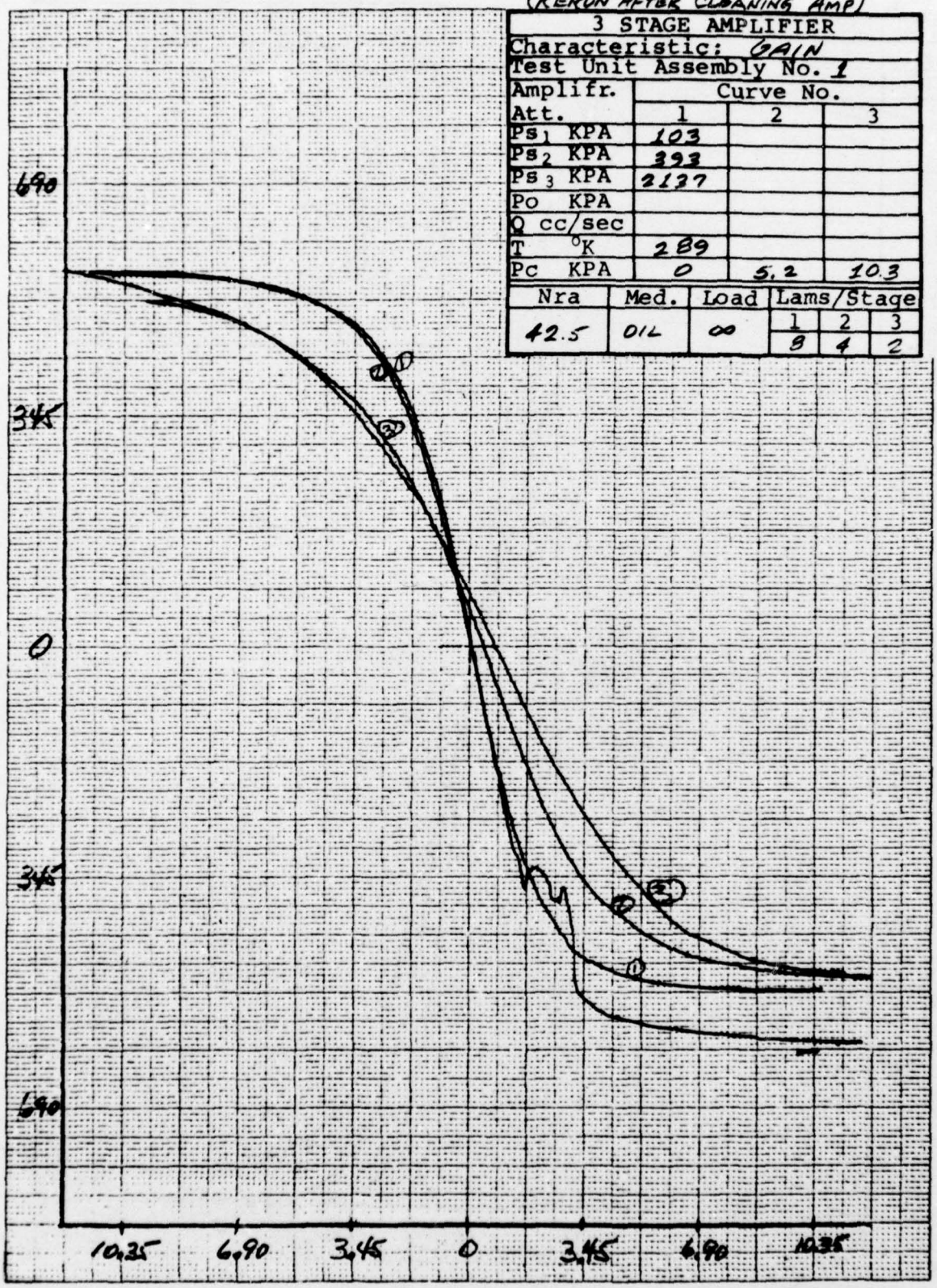

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 1
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA 29
Ps2 KPA 100
Ps3 KPA 580 Psi
Po KPA
Q cc/sec
T °K 305
Pc KPA 0 1.5 3.0
Nra 85
Med. OIL
Load ∞
Lams/Stage 1 2 3
B 4 2
400
300
200
100
0
100
200
300
400
6 4 2 0 2 4 6
ΔPc, psi
ΔPo, psi

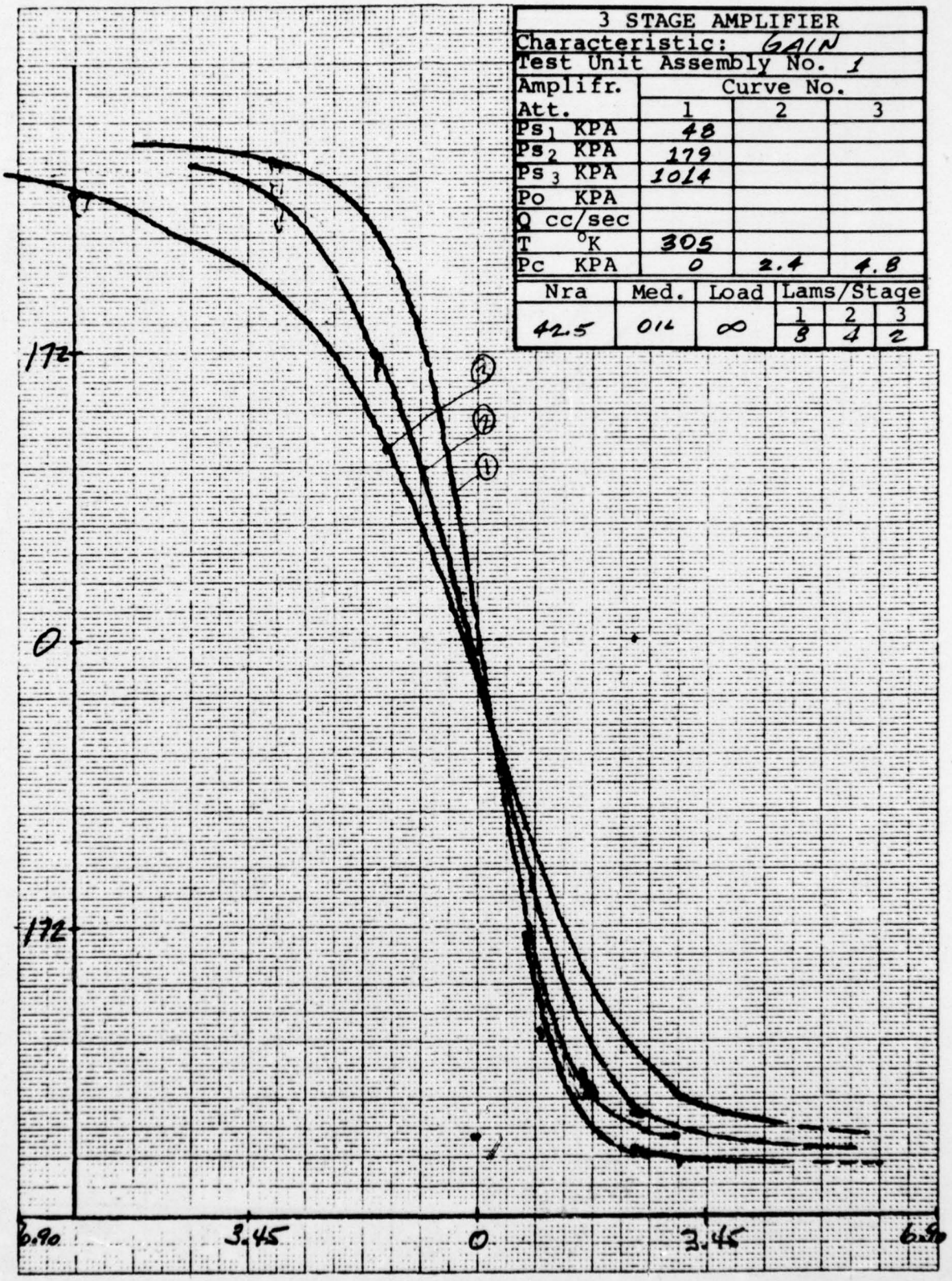

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 1
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA 9
Ps2 KPA 34 PSI
Ps3 KPA 200
Po KPA
Q cc/sec
T °K 330
Pc KPA 0 0.45 0.9
Nra 95
Med. Oil
Load ∞
Lams/Stage 1 2 3
8 4 2
50
0
50
1.5
1.0
.45
0
.45
1.0
.45
ΔPo, psi
ΔPc, psi

(RERUN AFTER CLEANING AMP)

| 3 STAGE AMPLIFIER | | | |
|---|---|---|---|
| Characteristic: GAIN | | | |
| Test Unit Assembly No. 1 | | | |
| Amplifr. Att. | Curve No. 1 | 2 | 3 |
| $Ps_1$ KPA | 103 | | |
| $Ps_2$ KPA | 393 | | |
| $Ps_3$ KPA | 2137 | | |
| Po KPA | | | |
| Q cc/sec | | | |
| T °K | 289 | | |
| Pc KPA | 0 | 5.2 | 10.3 |

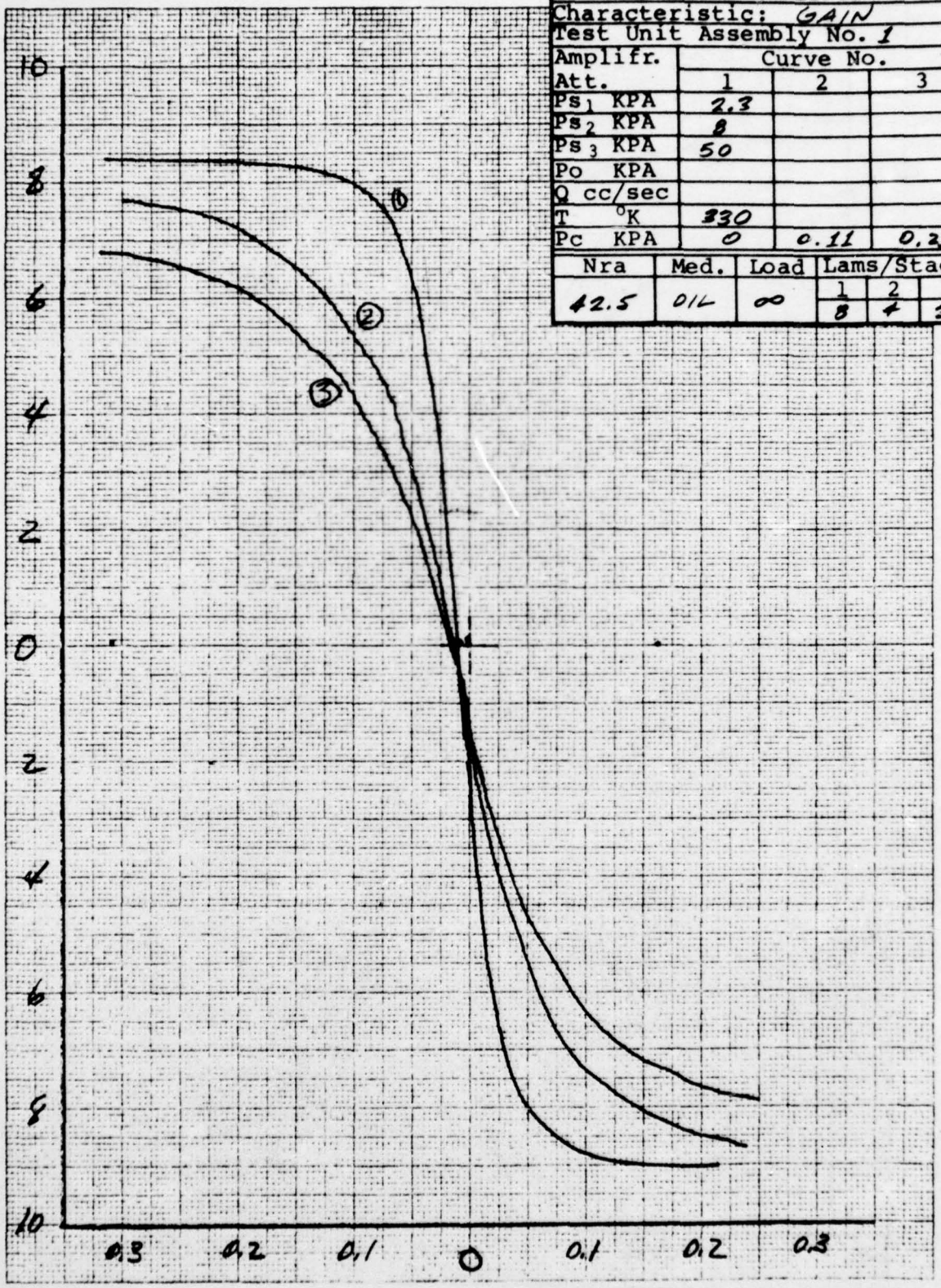
| Nra | Med. | Load | Lams/Stage | | |
|---|---|---|---|---|---|
| | | | 1 | 2 | 3 |
| 42.5 | OIL | ∞ | 8 | 4 | 2 |

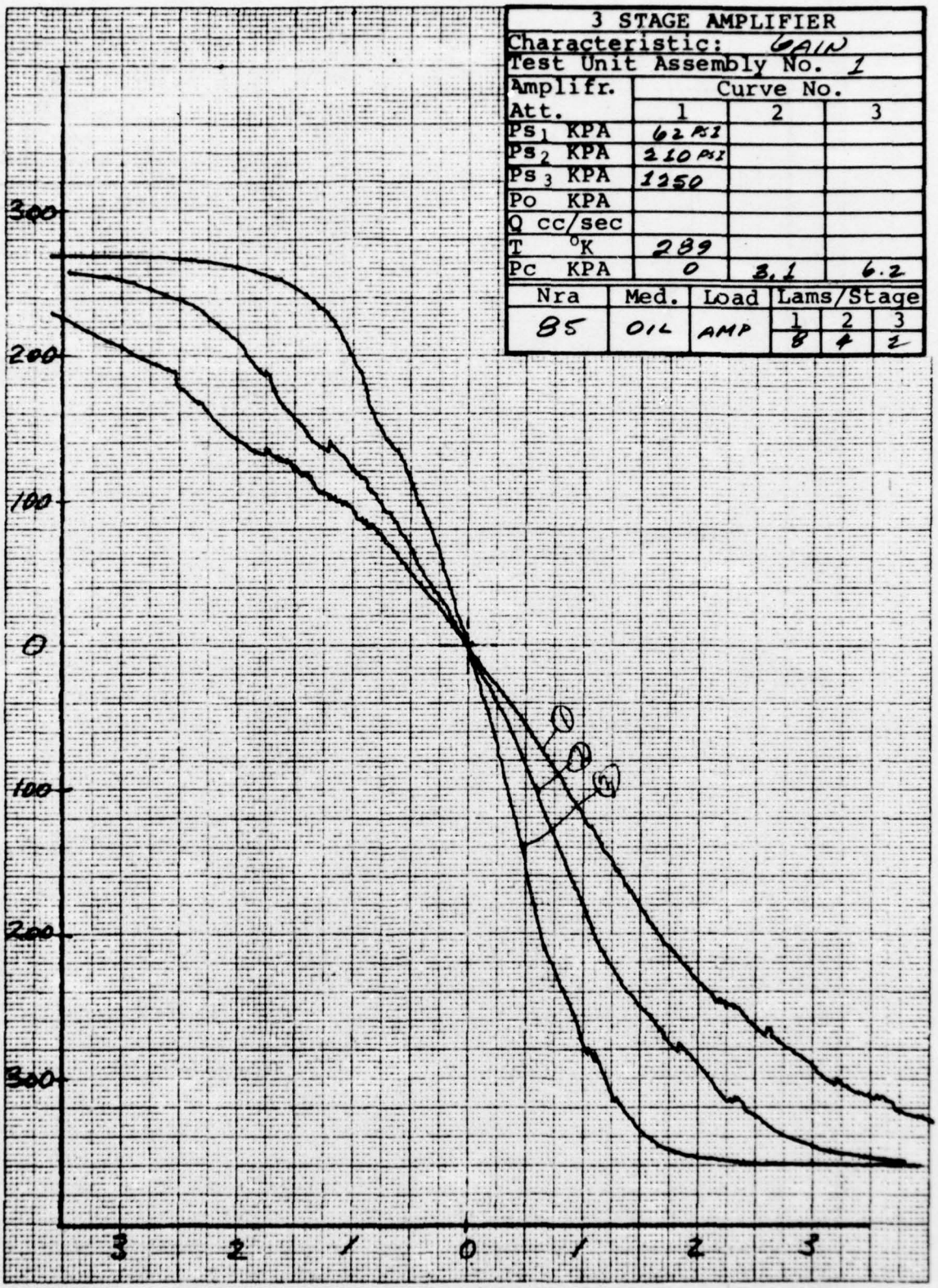


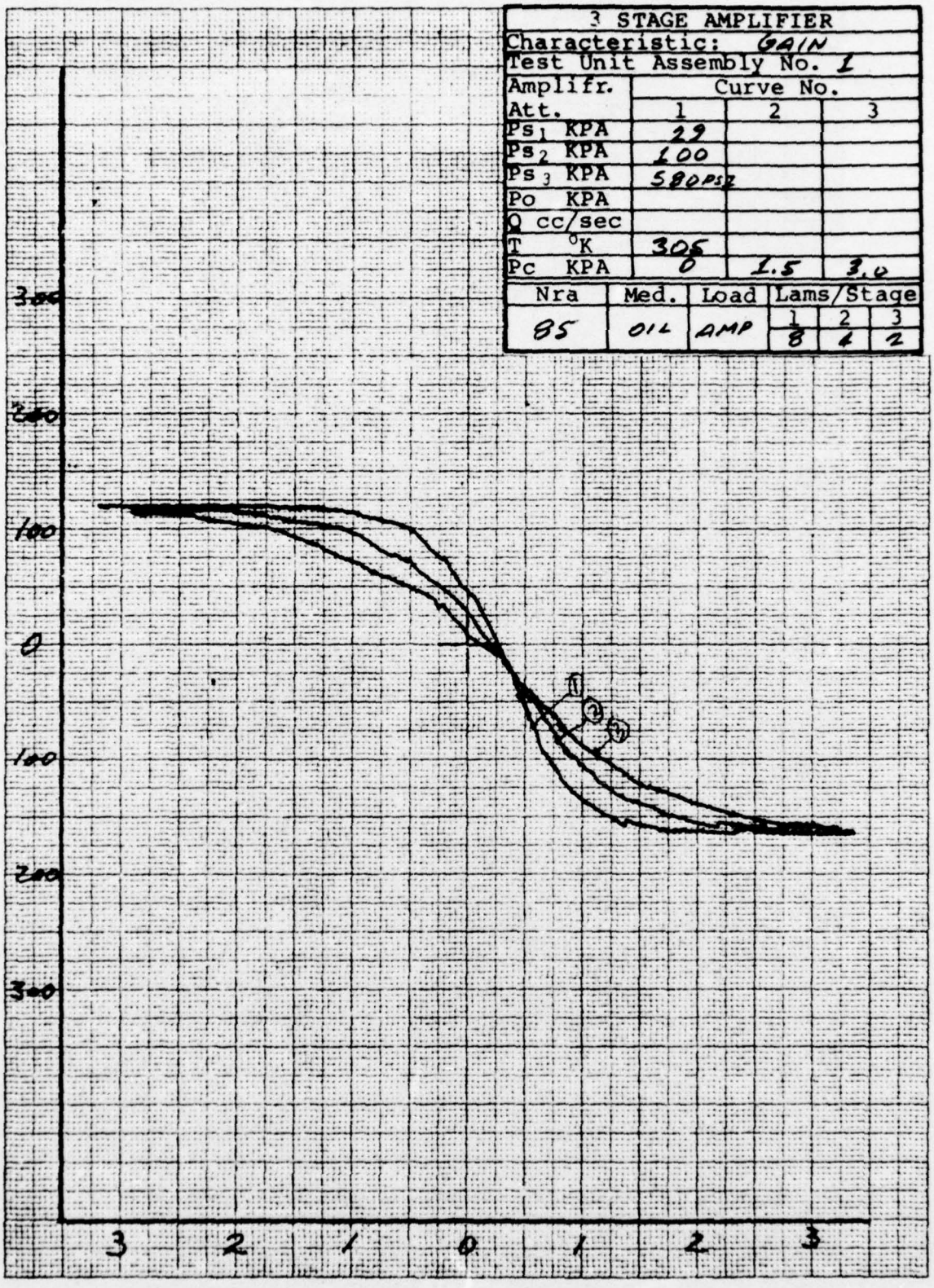

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 1
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA 48
Ps2 KPA 179
Ps3 KPA 1014
Po KPA
Q cc/sec
T °K 305
Pc KPA 0 2.4 4.8
Nra 42.5
Med. Oil
Load ∞
Lams/Stage 1/3 2/4 3/2
172
0
-172
6.90
3.45
0
3.45
6.90
ΔPo, PSI
ΔPc, PSI

| 3 STAGE AMPLIFIER | | | |
|---|---|---|---|
| Characteristic: GAIN | | | |
| Test Unit Assembly No. 1 | | | |
| Amplifr. Att. | Curve No. 1 | 2 | 3 |
| $Ps_1$ KPA | 2.3 | | |
| $Ps_2$ KPA | 8 | | |
| $Ps_3$ KPA | 50 | | |
| Po KPA | | | |
| Q cc/sec | | | |
| T °K | 330 | | |
| Pc KPA | 0 | 0.11 | 0.23 |

| Nra | Med. | Load | Lams/Stage 1 | 2 | 3 |
|---|---|---|---|---|---|
| 42.5 | OIL | ∞ | 8 | 4 | 2 |

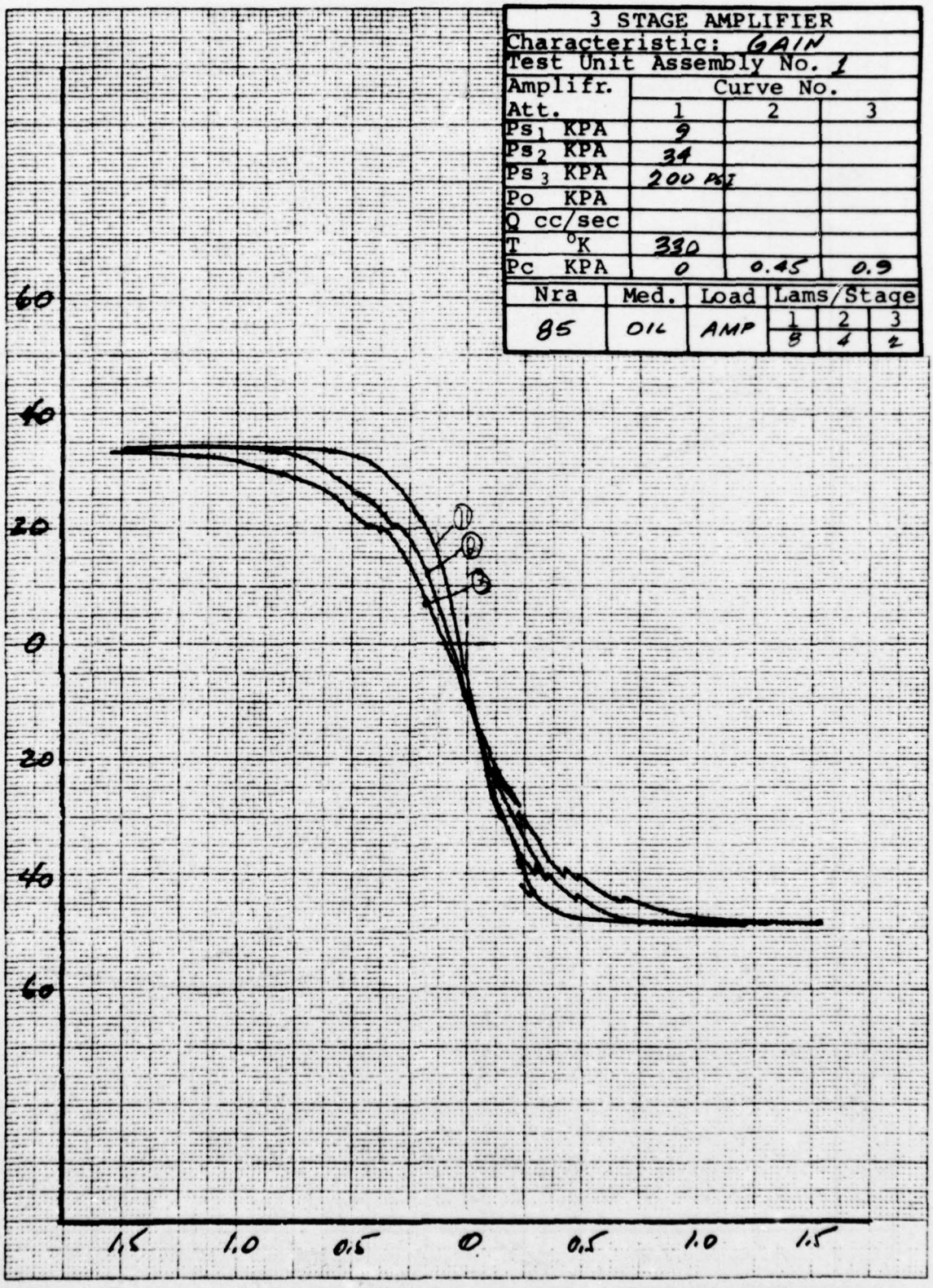



3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 1
Amplifr. Curve No.
Att. 1 2 3
Ps1 KPA 62 PSI
Ps2 KPA 210 PSI
Ps3 KPA 1250
Po KPA
Q cc/sec
T °K 289
Pc KPA 0 3.1 6.2
Nra Med. Load Lams/Stage 1 2 3
85 OIL AMP 8 4 2
300
200
100
0
100
200
300
3
2
1
0
1
2
3
ΔPs, PSI
ΔPc, PSI

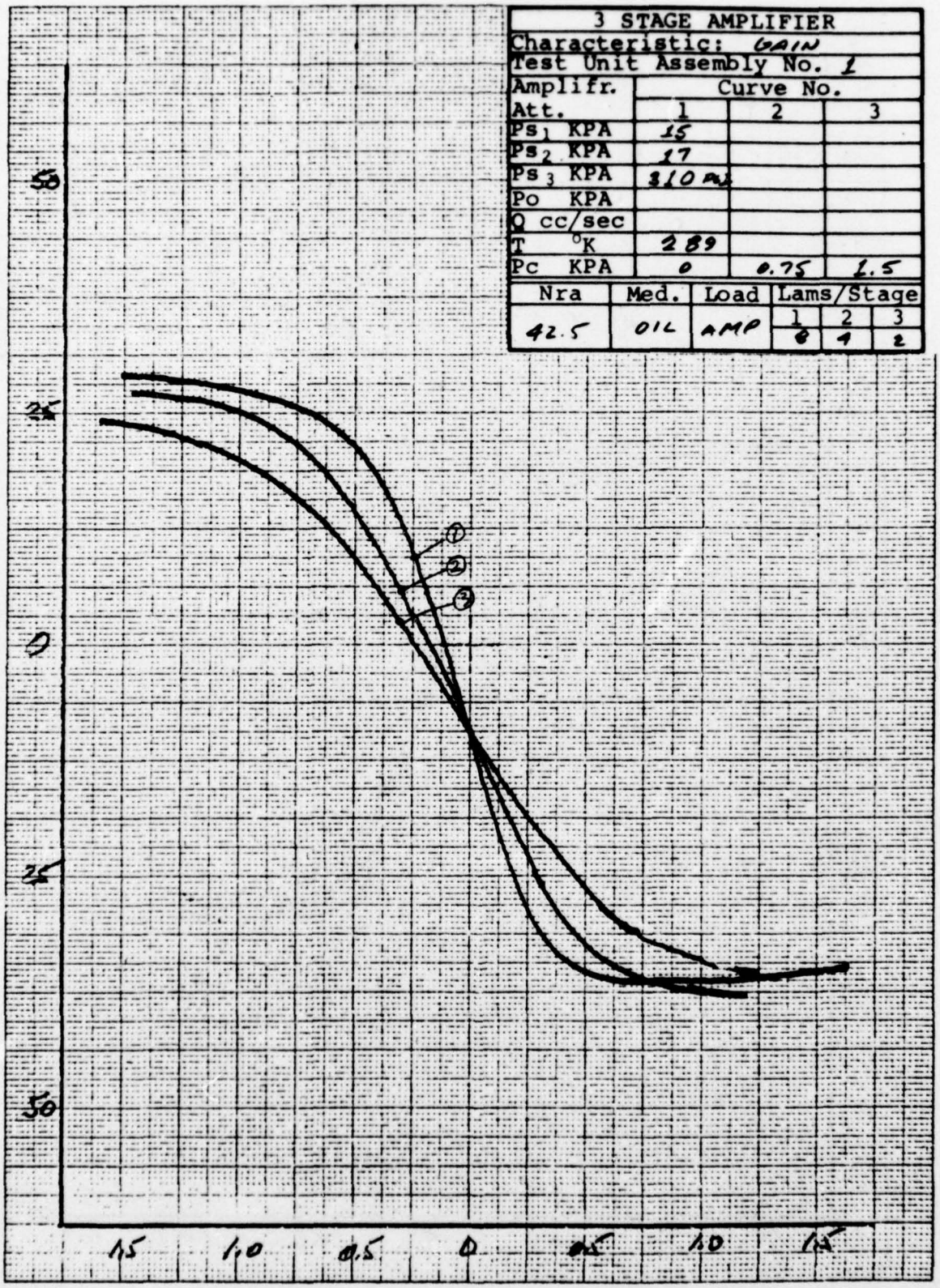

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 1
Amplifr. Att.
Curve No.
1
2
3
Ps1 KPA
29
Ps2 KPA
100
Ps3 KPA
580 PSIA
Po KPA
Q cc/sec
T °K
305
Pc KPA
0
1.5
3.0
Nra
Med.
Load
Lams/Stage
1
2
3
85
OIL
AMP
8
4
2
300
200
100
0
100
200
300
3
2
1
0
1
2
3
ΔPo, PSI
ΔPc, PSI

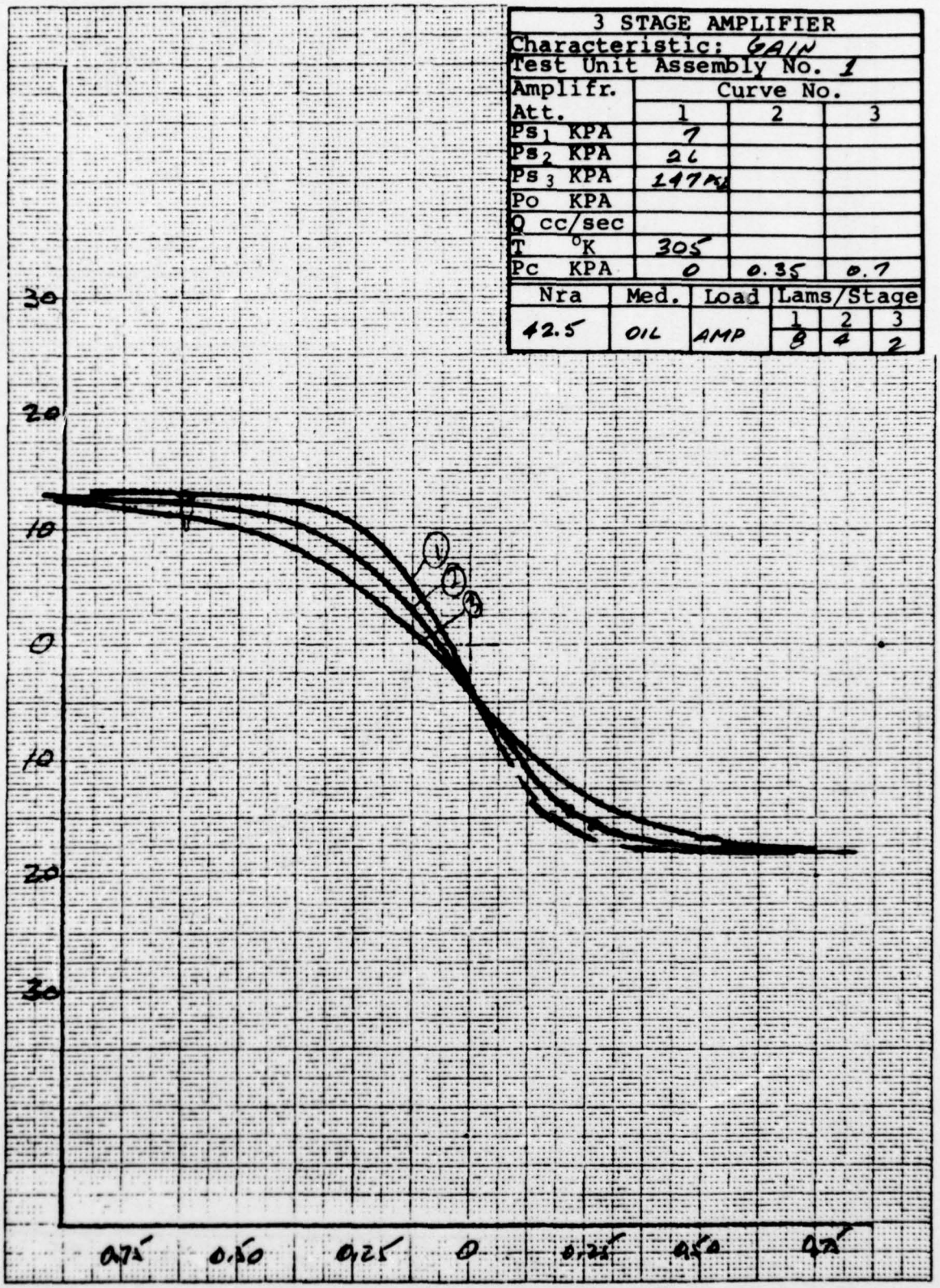
| 3 STAGE AMPLIFIER | | | | | |
|---|---|---|---|---|---|
| Characteristic: GAIN | | | | | |
| Test Unit Assembly No. 1 | | | | | |
| Amplifr. | Curve No. | | | | |
| Att. | 1 | 2 | 3 | | |
| $Ps_1$ KPA | 9 | | | | |
| $Ps_2$ KPA | 34 | | | | |
| $Ps_3$ KPA | 200 PSI | | | | |
| Po KPA | | | | | |
| Q cc/sec | | | | | |
| T °K | 330 | | | | |
| Pc KPA | 0 | 0.45 | 0.9 | | |

| Nra | Med. | Load | Lams/Stage | | |
|---|---|---|---|---|---|
| | | | 1 | 2 | 3 |
| 85 | OIL | AMP | 8 | 4 | 2 |



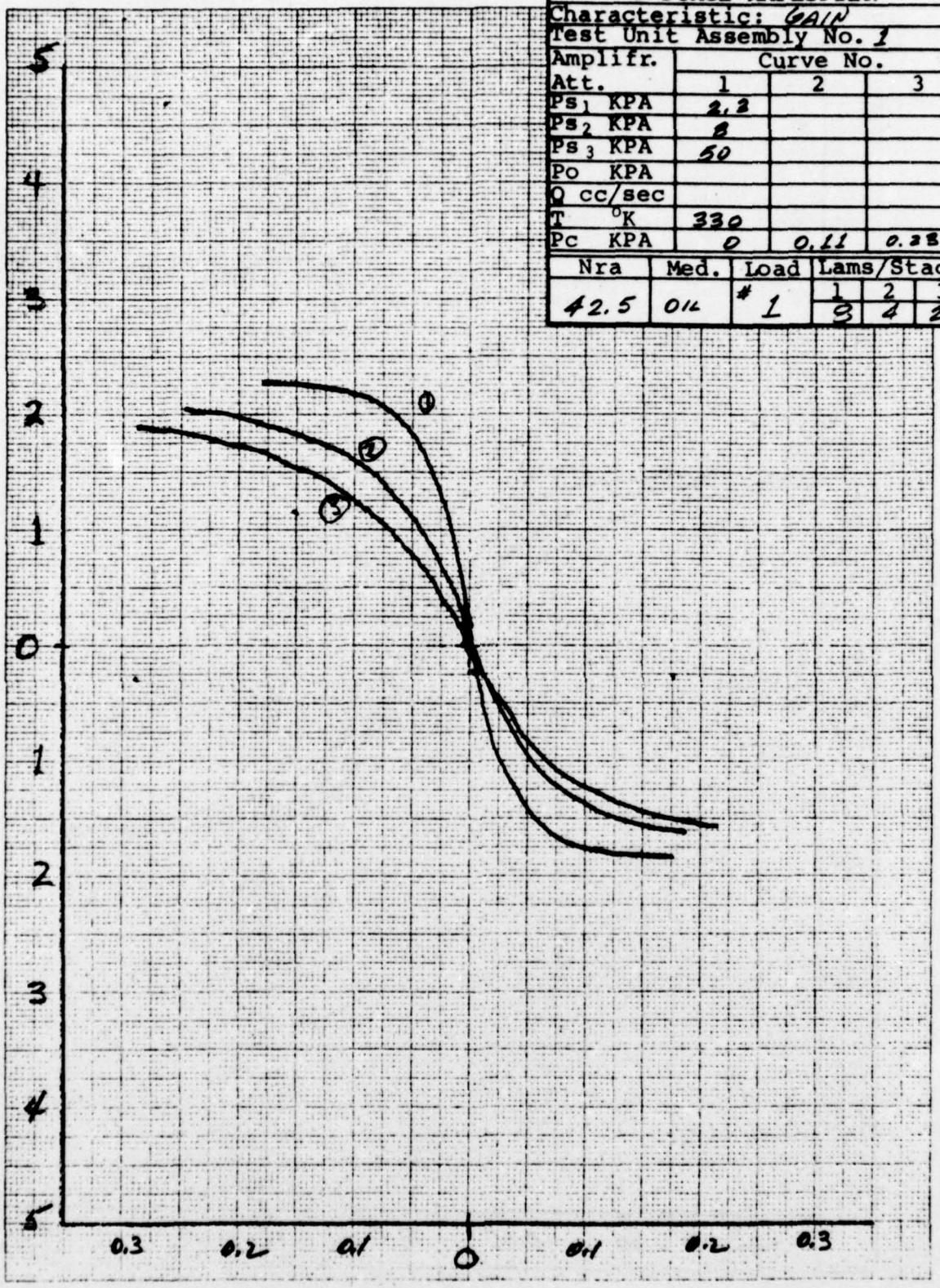
| 3 STAGE AMPLIFIER | | | | | |
|---|---|---|---|---|---|
| Characteristic: GAIN | | | | | |
| Test Unit Assembly No. 1 | | | | | |
| Amplifr. | Curve No. | | | | |
| Att. | 1 | 2 | 3 | | |
| $Ps_1$ KPA | 15 | | | | |
| $Ps_2$ KPA | 17 | | | | |
| $Ps_3$ KPA | 310 PSI | | | | |
| Po KPA | | | | | |
| Q cc/sec | | | | | |
| T °K | 289 | | | | |
| Pc KPA | 0 | 0.75 | 1.5 | | |
| Nra | Med. | Load | Lams/Stage | | |
| | | | 1 | 2 | 3 |
| 42.5 | OIL | AMP | 0 | 1 | 2 |




3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 1
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA 7
Ps2 KPA 21
Ps3 KPA 147 KPA
Po KPA
Q cc/sec
T °K 305
Pc KPA 0 0.35 0.7
Nra 42.5
Med. OIL
Load AMP
Lams/Stage 1 2 3 8 4 2
30
20
10
0
10
20
30
0.75
0.50
0.25
0
0.25
0.50
0.75
ΔPo, psi
ΔPc, psi

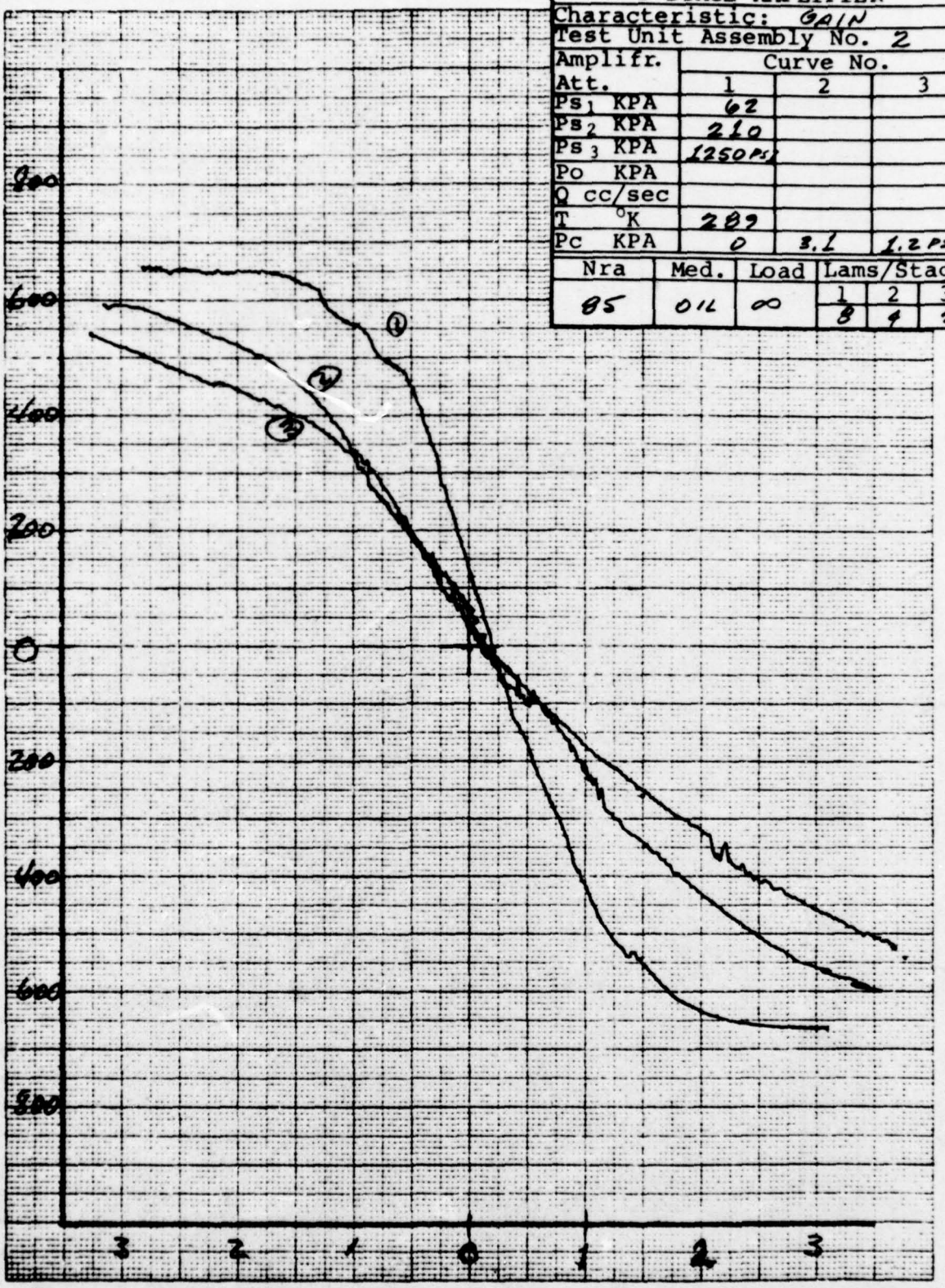
| 3 STAGE AMPLIFIER | | | |
|---|---|---|---|
| Characteristic: GAIN | | | |
| Test Unit Assembly No. 1 | | | |
| Amplifr. Att. | Curve No. | | |
| | 1 | 2 | 3 |
| $Ps_1$ KPA | 2.2 | | |
| $Ps_2$ KPA | 8 | | |
| $Ps_3$ KPA | 50 | | |
| Po KPA | | | |
| Q cc/sec | | | |
| T °K | 330 | | |
| Pc KPA | 0 | 0.11 | 0.28 |

| Nra | Med. | Load | Lams/Stage | | |
|---|---|---|---|---|---|
| | | | 1 | 2 | 3 |
| 42.5 | 014 | # 1 | 3 | 4 | 2 |



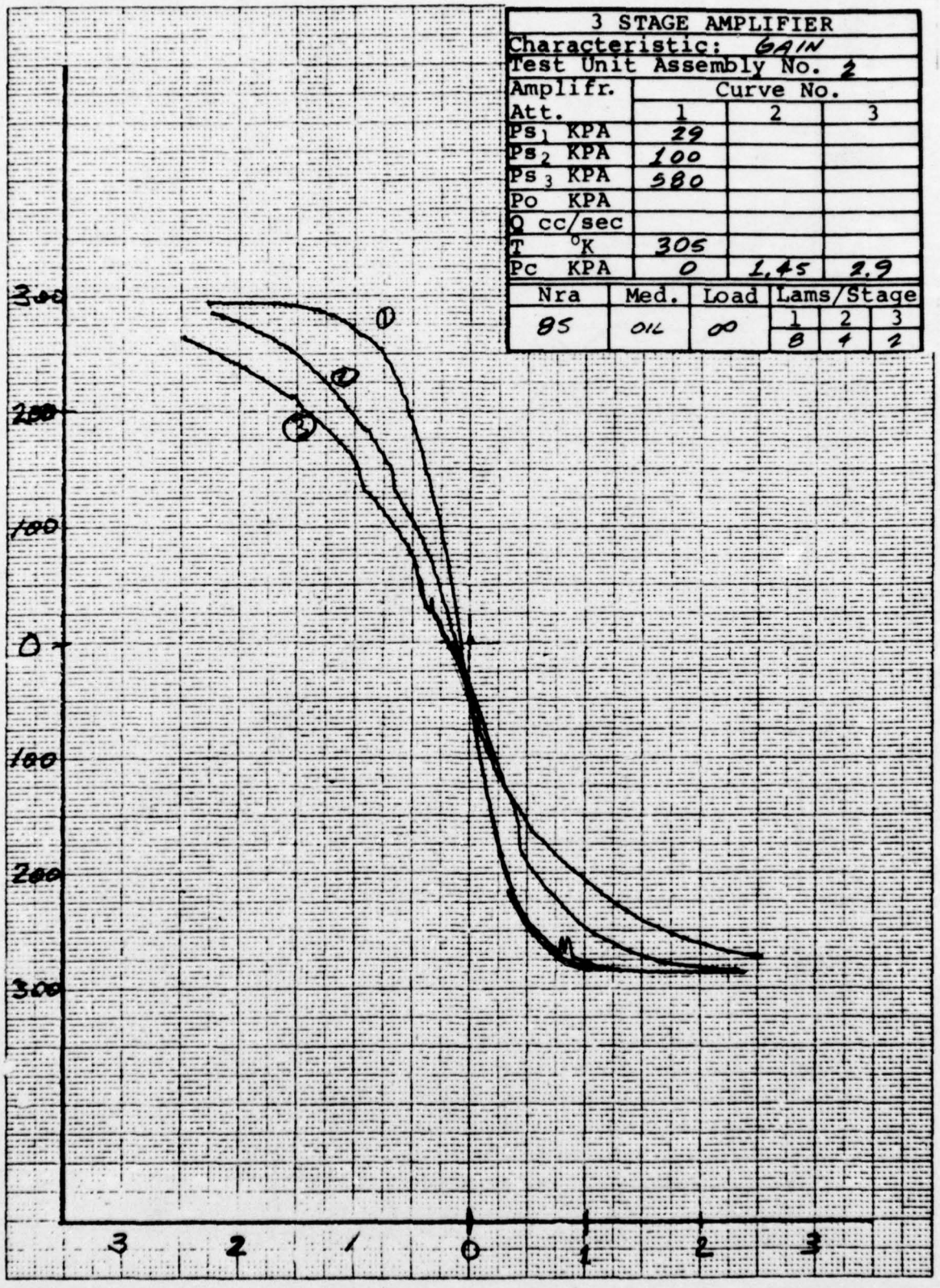
| 3 STAGE AMPLIFIER | | | |
|---|---|---|---|
| Characteristic: GAIN | | | |
| Test Unit Assembly No. 2 | | | |
| Amplifr. Att. | Curve No. | | |
| | 1 | 2 | 3 |
| $Ps_1$ KPA | 62 | | |
| $Ps_2$ KPA | 210 | | |
| $Ps_3$ KPA | 1250 PSI | | |
| Po KPA | | | |
| Q cc/sec | | | |
| T °K | 289 | | |
| Pc KPA | 0 | 3.1 | 1.2 PSI |

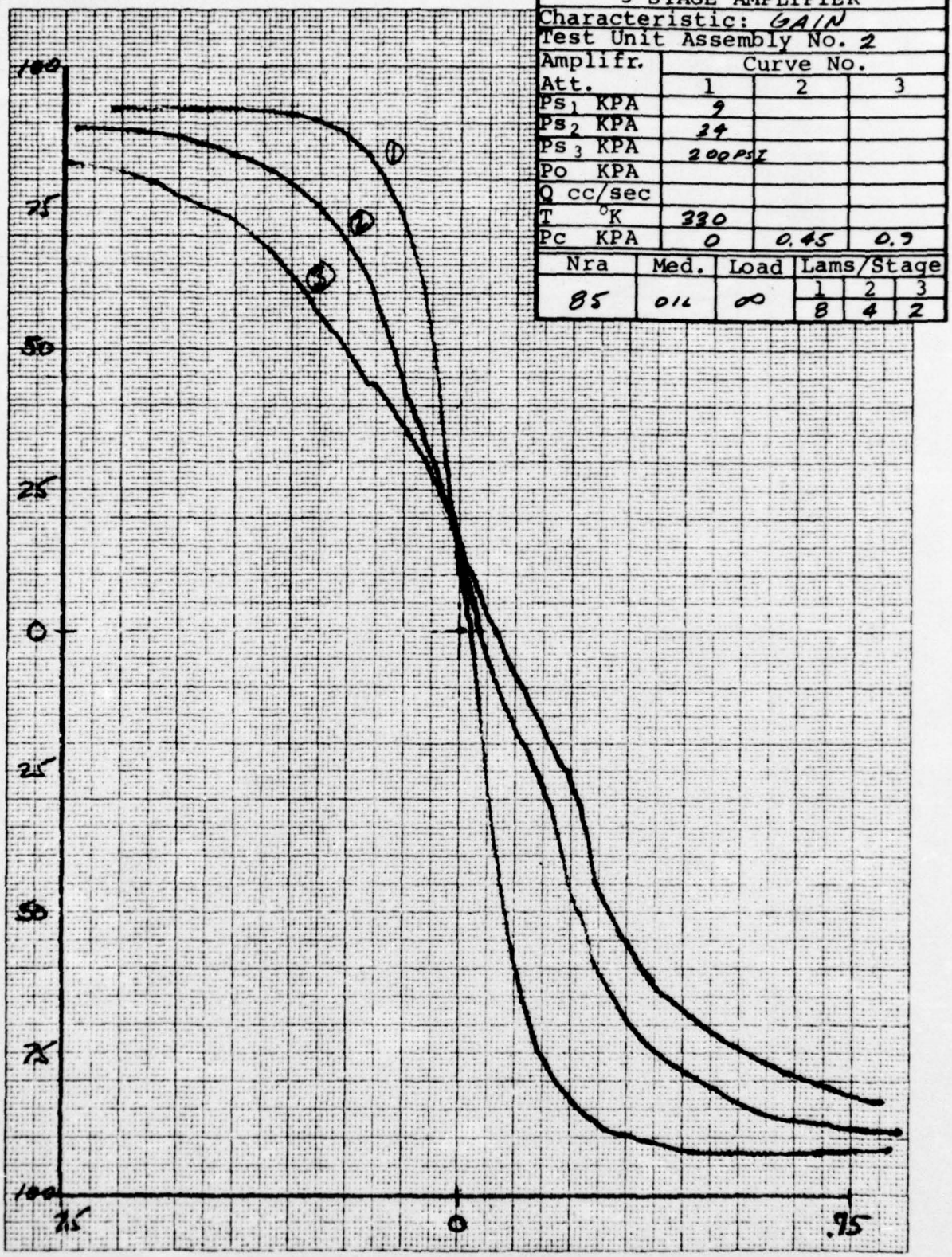
| Nra | Med. | Load | Lams/Stage | | |
|---|---|---|---|---|---|
| | | | 1 | 2 | 3 |
| 85 | OIL | ∞ | 8 | 4 | 2 |



| 3 STAGE AMPLIFIER | | | |
|---|---|---|---|
| Characteristic: GAIN | | | |
| Test Unit Assembly No. 2 | | | |
| Amplifr. | Curve No. | | |
| Att. | 1 | 2 | 3 |
| $Ps_1$ KPA | 29 | | |
| $Ps_2$ KPA | 100 | | |
| $Ps_3$ KPA | 580 | | |
| Po KPA | | | |
| Q cc/sec | | | |
| T °K | 305 | | |
| Pc KPA | 0 | 1.45 | 2.9 |

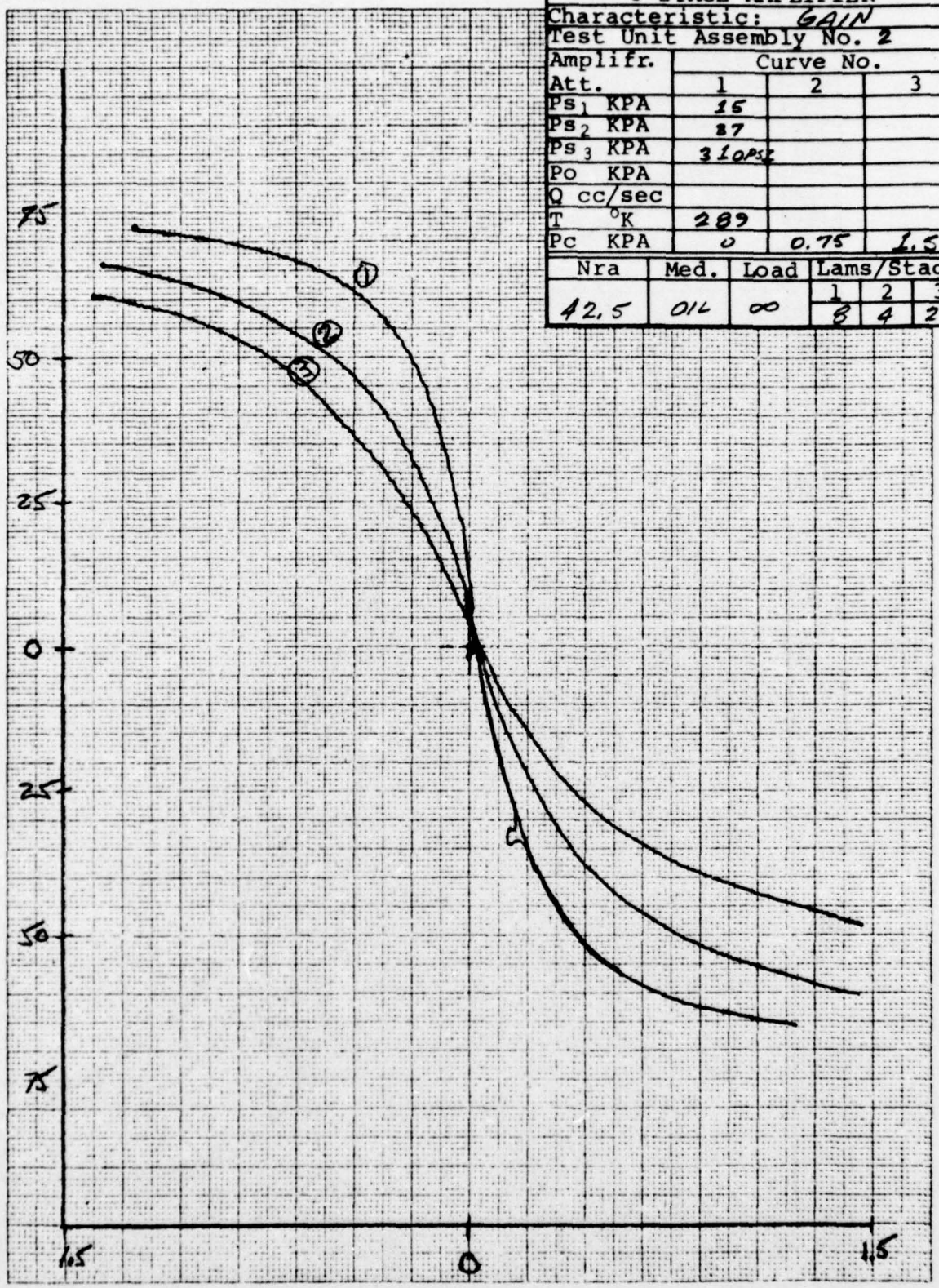
| Nra | Med. | Load | Lams/Stage | | |
|---|---|---|---|---|---|
| | | | 1 | 2 | 3 |
| 85 | OIL | ∞ | 8 | 4 | 2 |






| 3 STAGE AMPLIFIER | | | |
|---|---|---|---|
| Characteristic: GAIN | | | |
| Test Unit Assembly No. 2 | | | |
| Amplifr. Att. | Curve No. 1 | Curve No. 2 | Curve No. 3 |
| $Ps_1$ KPA | 9 | | |
| $Ps_2$ KPA | 34 | | |
| $Ps_3$ KPA | 200 PSI | | |
| Po KPA | | | |
| Q cc/sec | | | |
| T °K | 330 | | |
| Pc KPA | 0 | 0.45 | 0.9 |

| Nra | Med. | Load | Lams/Stage 1 | 2 | 3 |
|---|---|---|---|---|---|
| 85 | 011 | ∞ | 8 | 4 | 2 |

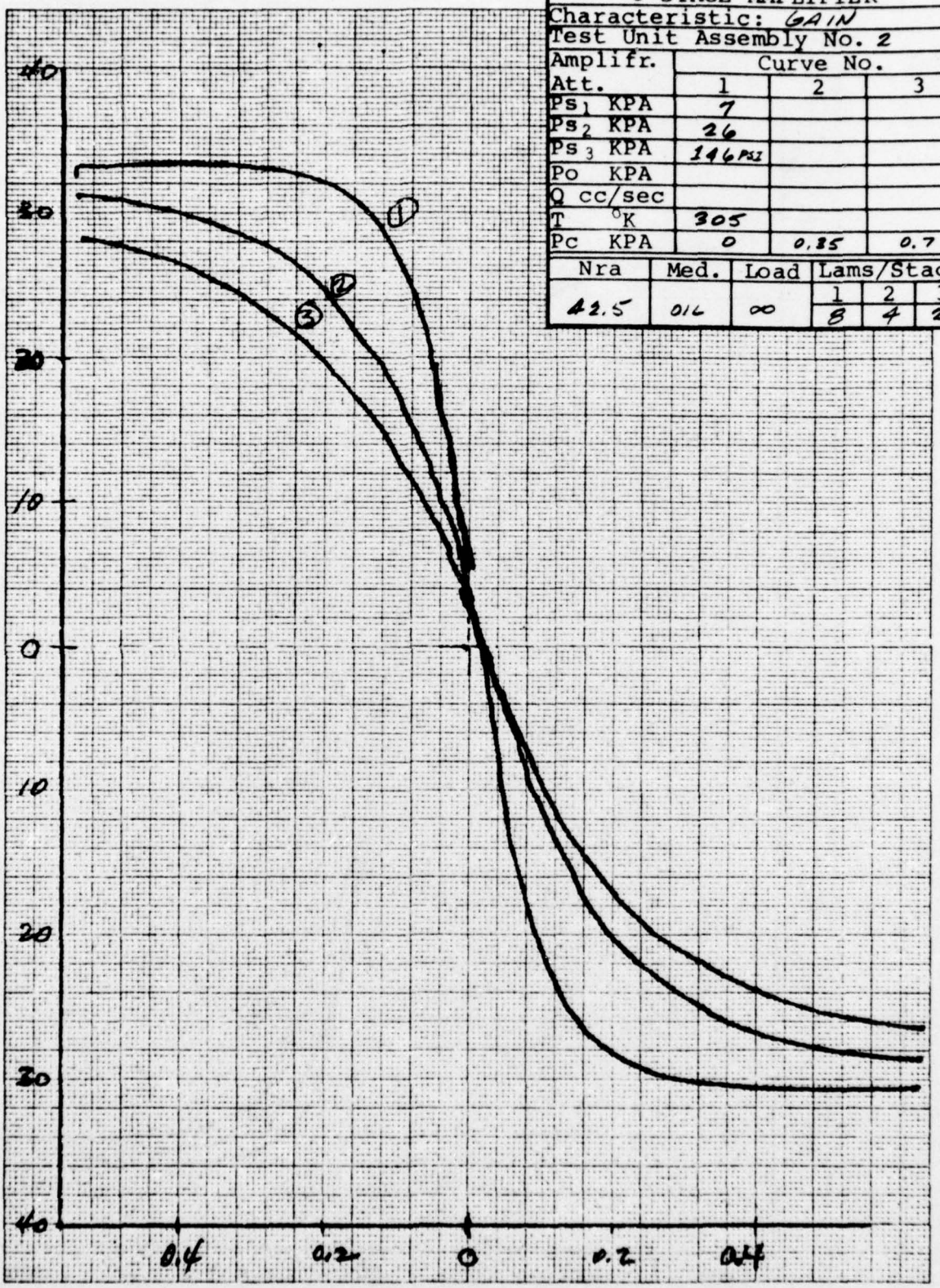



| 3 STAGE AMPLIFIER | | | |
|---|---|---|---|
| Characteristic: GAIN | | | |
| Test Unit Assembly No. 2 | | | |
| Amplifr. Att. | Curve No. 1 | 2 | 3 |
| $Ps_1$ KPA | 15 | | |
| $Ps_2$ KPA | 87 | | |
| $Ps_3$ KPA | 310 psi | | |
| Po KPA | | | |
| Q cc/sec | | | |
| T °K | 289 | | |
| Pc KPA | 0 | 0.75 | 1.5 |

| Nra | Med. | Load | Lams/Stage 1 | 2 | 3 |
|---|---|---|---|---|---|
| 42.5 | OIL | ∞ | 8 | 4 | 2 |

| 3 STAGE AMPLIFIER | | | | | |
|---|---|---|---|---|---|
| Characteristic: GAIN | | | | | |
| Test Unit Assembly No. 2 | | | | | |
| Amplifr. Att. | Curve No. | | | | |
| | 1 | 2 | 3 | | |
| $Ps_1$ KPA | 7 | | | | |
| $Ps_2$ KPA | 26 | | | | |
| $Ps_3$ KPA | 146 PSI | | | | |
| Po KPA | | | | | |
| Q cc/sec | | | | | |
| T °K | 305 | | | | |
| Pc KPA | 0 | 0.35 | 0.7 | | |

| Nra | Med. | Load | Lams/Stage | | |
|---|---|---|---|---|---|
| | | | 1 | 2 | 3 |
| 42.5 | OIL | ∞ | 8 | 4 | 2 |

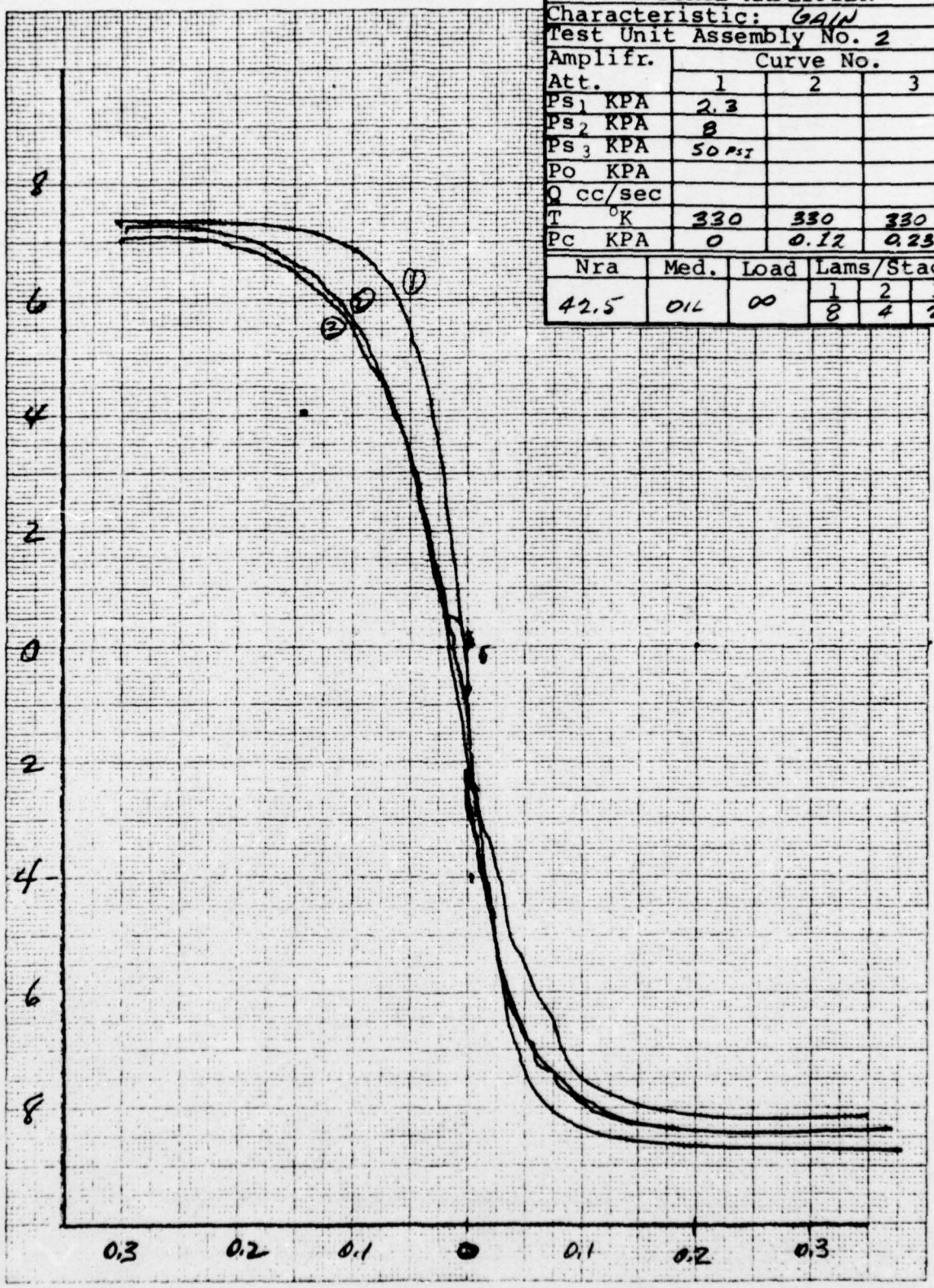



$\Delta P_o$, PSI

$\Delta P_c$, PSI

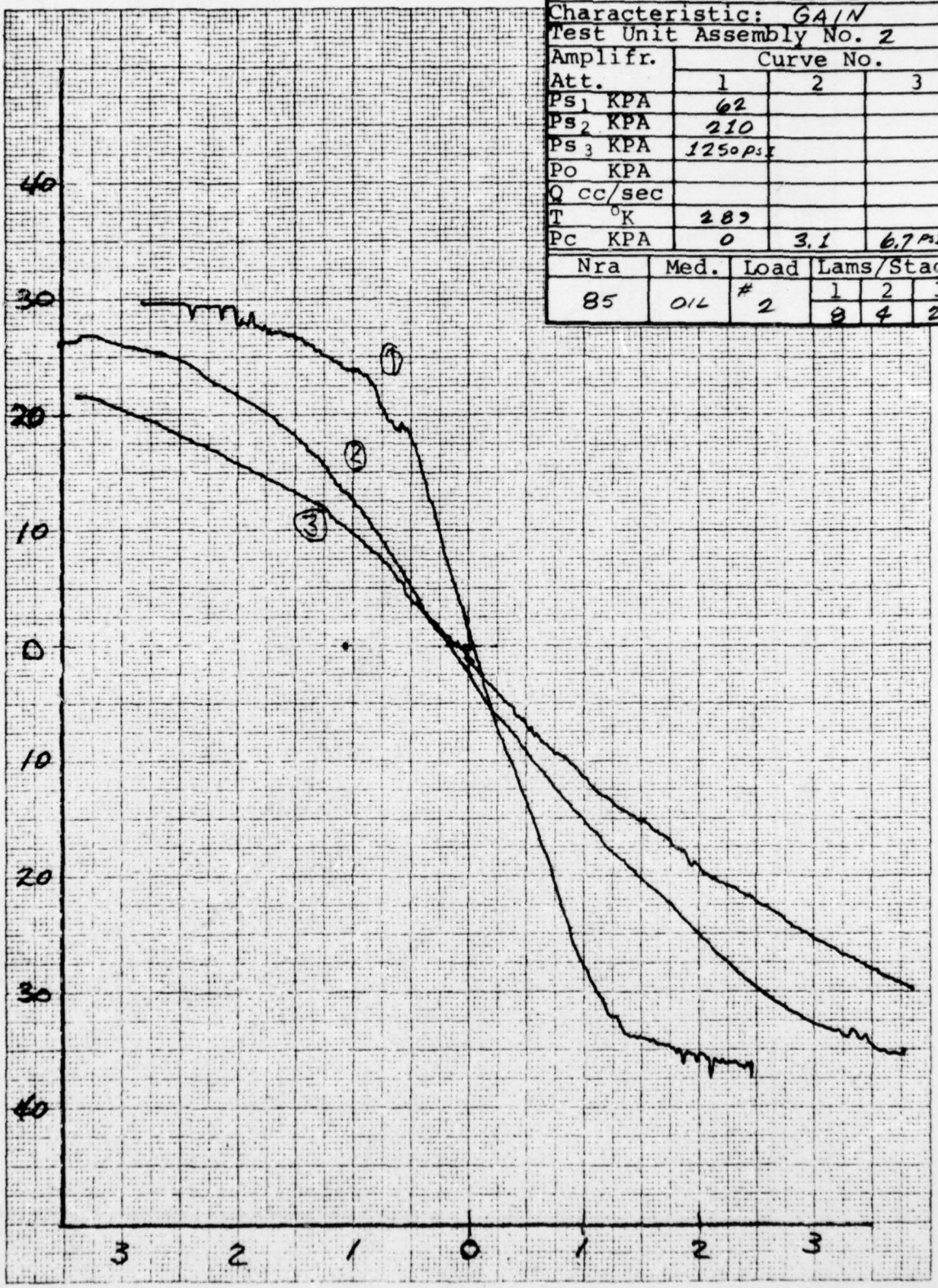
| 3 STAGE AMPLIFIER | | | |
|---|---|---|---|
| Characteristic: GAIN | | | |
| Test Unit Assembly No. 2 | | | |
| Amplifr. Att. | Curve No. 1 | 2 | 3 |
| $Ps_1$ KPA | 2.3 | | |
| $Ps_2$ KPA | 8 | | |
| $Ps_3$ KPA | 50 PSI | | |
| Po KPA | | | |
| Q cc/sec | | | |
| T °K | 330 | 330 | 330 |
| Pc KPA | 0 | 0.12 | 0.23 |

| Nra | Med. | Load | Lams/Stage | | |
|---|---|---|---|---|---|
| | | | 1 | 2 | 3 |
| 42.5 | OIL | ∞ | 8 | 4 | 2 |



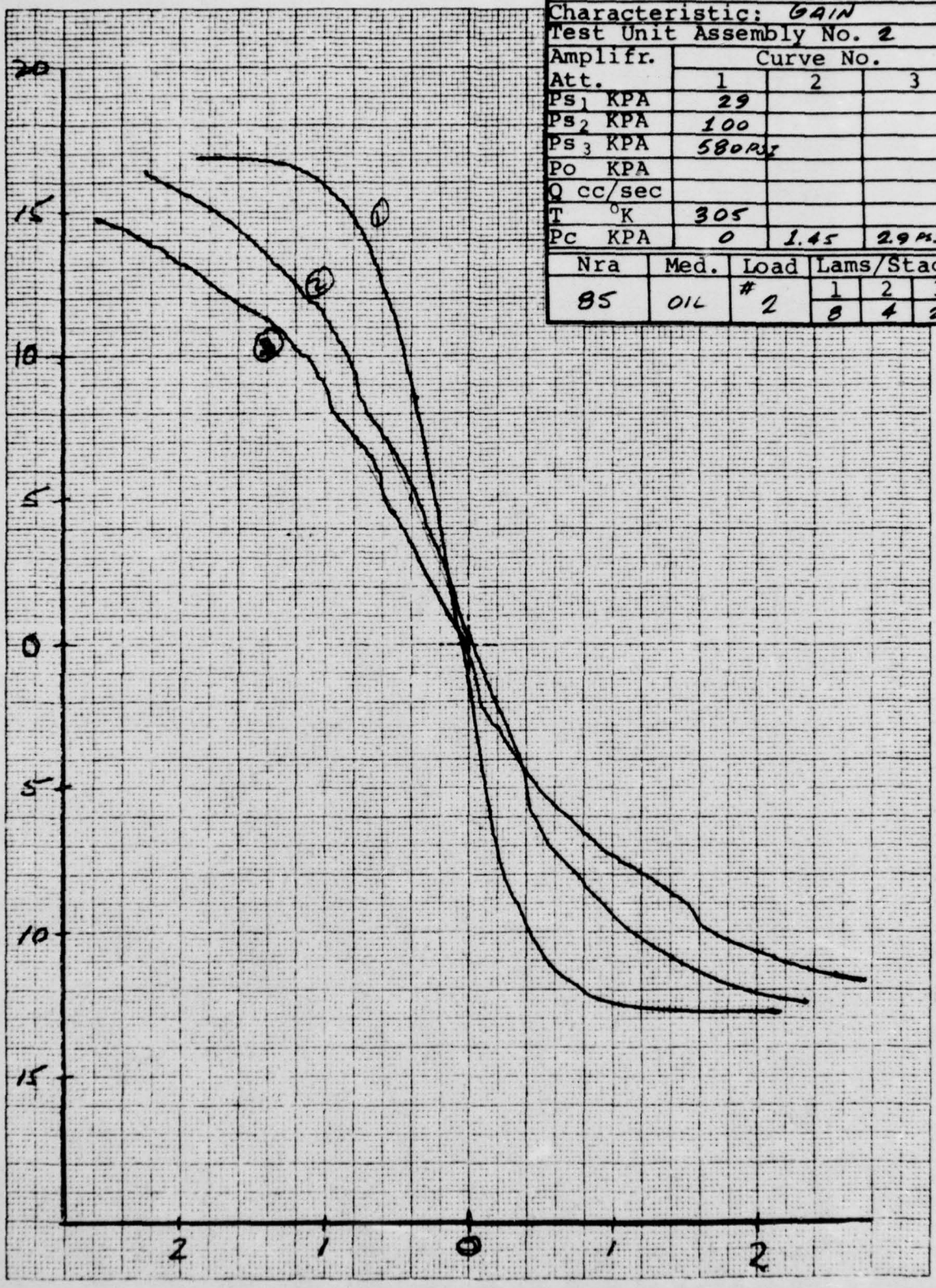
| 3 STAGE AMPLIFIER | | | |
|---|---|---|---|
| Characteristic: GAIN | | | |
| Test Unit Assembly No. 2 | | | |
| Amplifr. Att. | Curve No. 1 | 2 | 3 |
| $Ps_1$ KPA | 62 | | |
| $Ps_2$ KPA | 210 | | |
| $Ps_3$ KPA | 1250 psi | | |
| Po KPA | | | |
| Q cc/sec | | | |
| T °K | 283 | | |
| Pc KPA | 0 | 3.1 | 6.7 psi |

| Nra | Med. | Load | Lams/Stage 1 | 2 | 3 |
|---|---|---|---|---|---|
| 85 | OIL | # 2 | 8 | 4 | 2 |



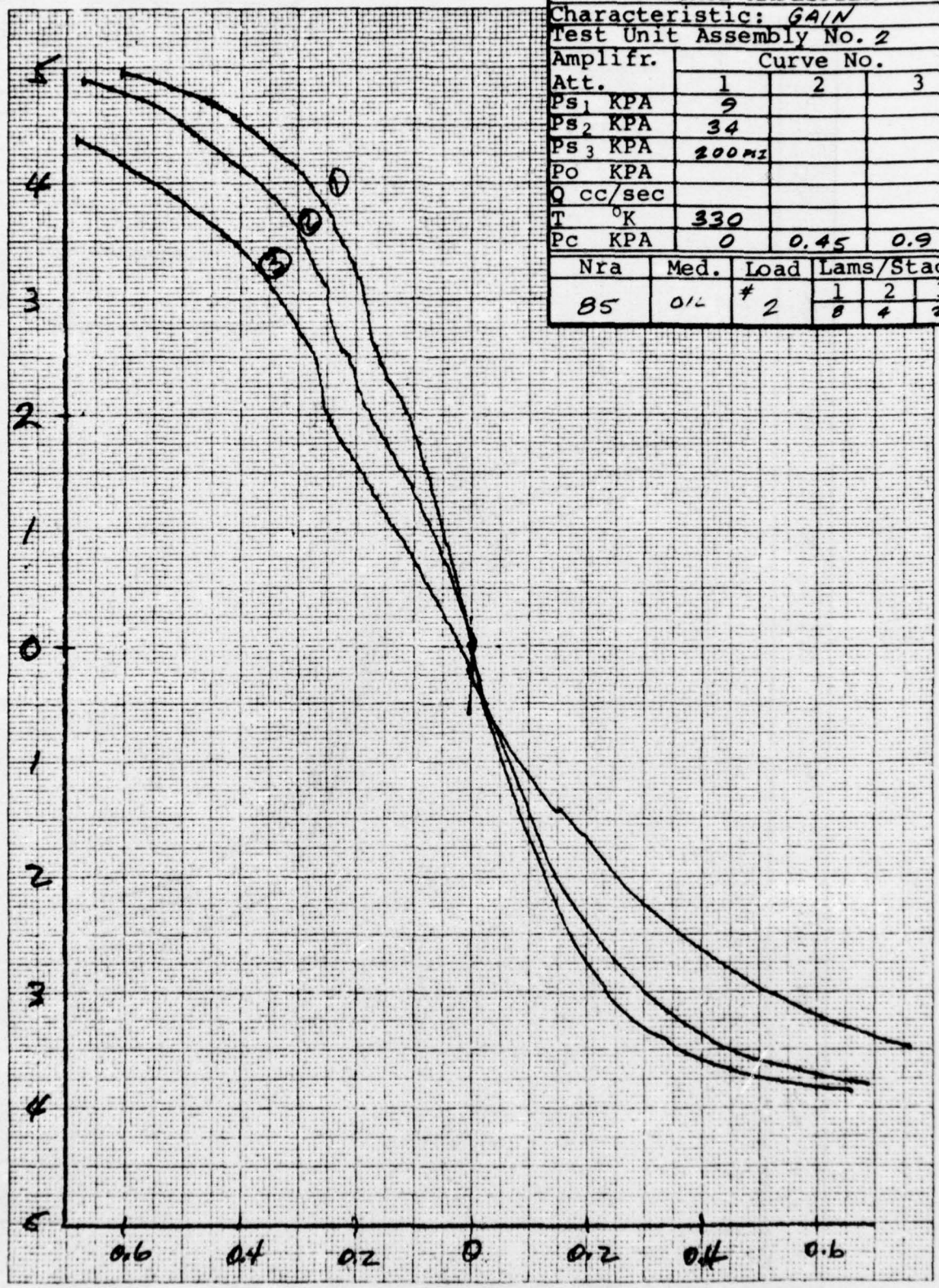
| 3 STAGE AMPLIFIER | | | |
|---|---|---|---|
| Characteristic: GAIN | | | |
| Test Unit Assembly No. 2 | | | |
| Amplifr. Att. | Curve No. 1 | 2 | 3 |
| $Ps_1$ KPA | 29 | | |
| $Ps_2$ KPA | 100 | | |
| $Ps_3$ KPA | 580 PSI | | |
| Po KPA | | | |
| Q cc/sec | | | |
| T °K | 305 | | |
| Pc KPA | 0 | 1.45 | 2.9 PSI |

| Nra | Med. | Load | Lams/Stage 1 | 2 | 3 |
|---|---|---|---|---|---|
| 85 | OIL | # 2 | 8 | 4 | 2 |



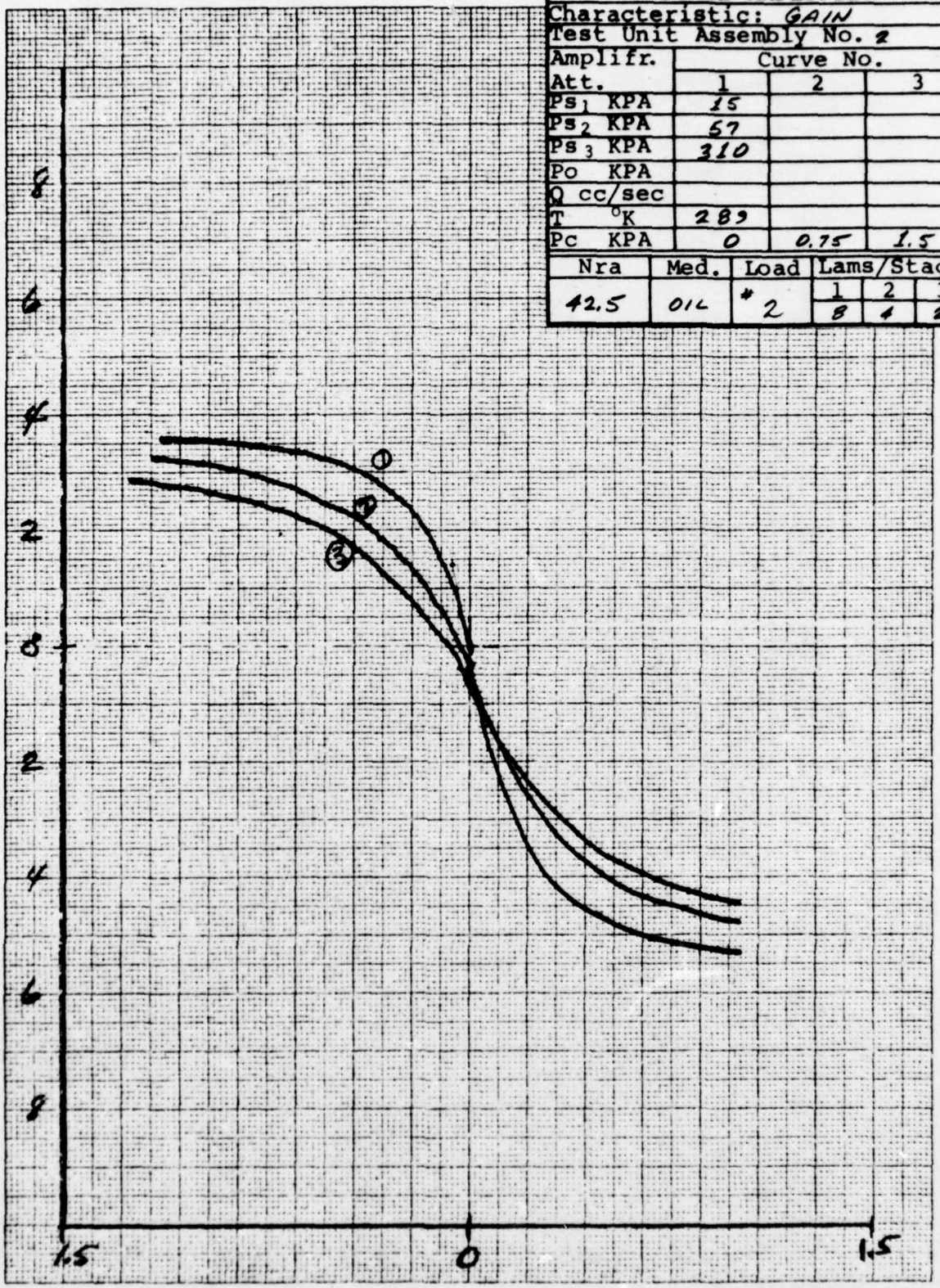
| 3 STAGE AMPLIFIER | | | |
|---|---|---|---|
| Characteristic: GAIN | | | |
| Test Unit Assembly No. 2 | | | |
| Amplifr. Att. | Curve No. 1 | 2 | 3 |
| $Ps_1$ KPA | 9 | | |
| $Ps_2$ KPA | 34 | | |
| $Ps_3$ KPA | 200 mi | | |
| Po KPA | | | |
| Q cc/sec | | | |
| T °K | 330 | | |
| Pc KPA | 0 | 0.45 | 0.9 |

| Nra | Med. | Load | Lams/Stage 1 | 2 | 3 |
|---|---|---|---|---|---|
| 85 | oil | # 2 | 8 | 4 | 2 |



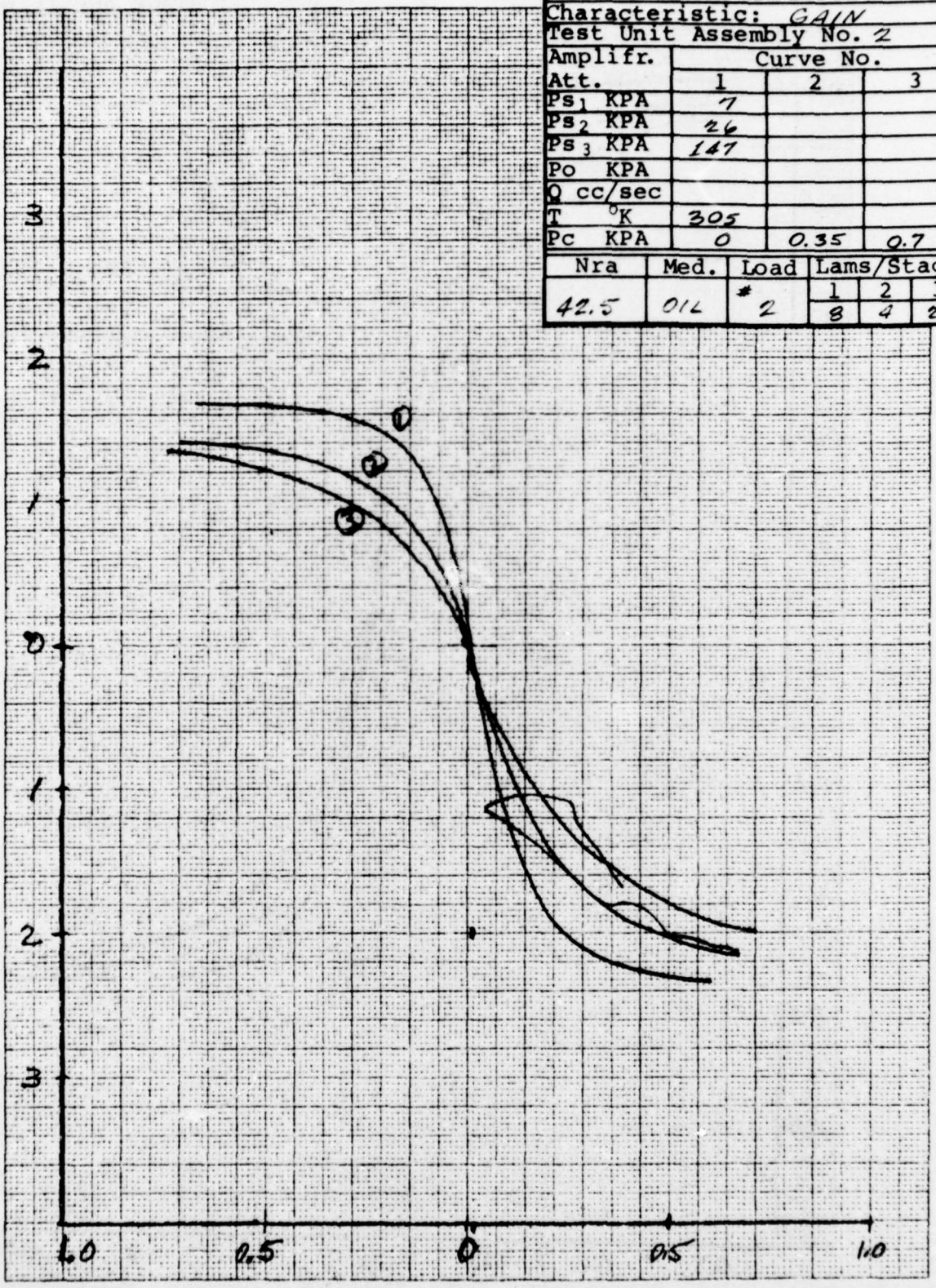
| 3 STAGE AMPLIFIER | | | |
|---|---|---|---|
| Characteristic: GAIN | | | |
| Test Unit Assembly No. 2 | | | |
| Amplifr. Att. | Curve No. | | |
| | 1 | 2 | 3 |
| $Ps_1$ KPA | 15 | | |
| $Ps_2$ KPA | 57 | | |
| $Ps_3$ KPA | 310 | | |
| Po KPA | | | |
| Q cc/sec | | | |
| T °K | 289 | | |
| Pc KPA | 0 | 0.75 | 1.5 |

| Nra | Med. | Load | Lams/Stage | | |
|---|---|---|---|---|---|
| | | | 1 | 2 | 3 |
| 42.5 | OIL | # 2 | 8 | 4 | 2 |



| 3 STAGE AMPLIFIER | | | |
|---|---|---|---|
| Characteristic: GAIN | | | |
| Test Unit Assembly No. 2 | | | |
| Amplifr. Att. | Curve No. 1 | 2 | 3 |
| $Ps_1$ KPA | 7 | | |
| $Ps_2$ KPA | 26 | | |
| $Ps_3$ KPA | 147 | | |
| Po KPA | | | |
| Q cc/sec | | | |
| T °K | 305 | | |
| Pc KPA | 0 | 0.35 | 0.7 |

| Nra | Med. | Load | Lams/Stage 1 | 2 | 3 |
|---|---|---|---|---|---|
| 42.5 | OIL | # 2 | 8 | 4 | 2 |

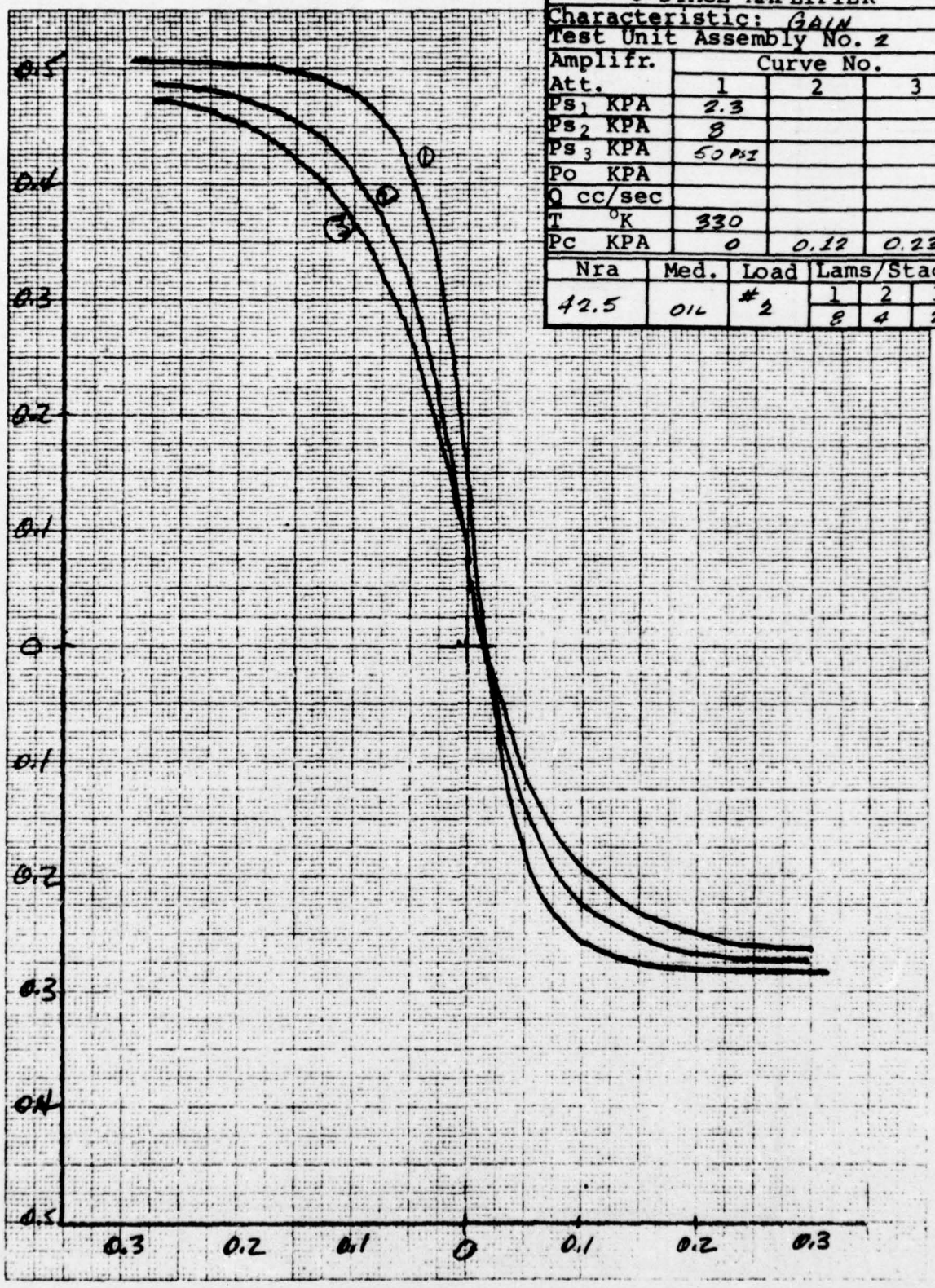


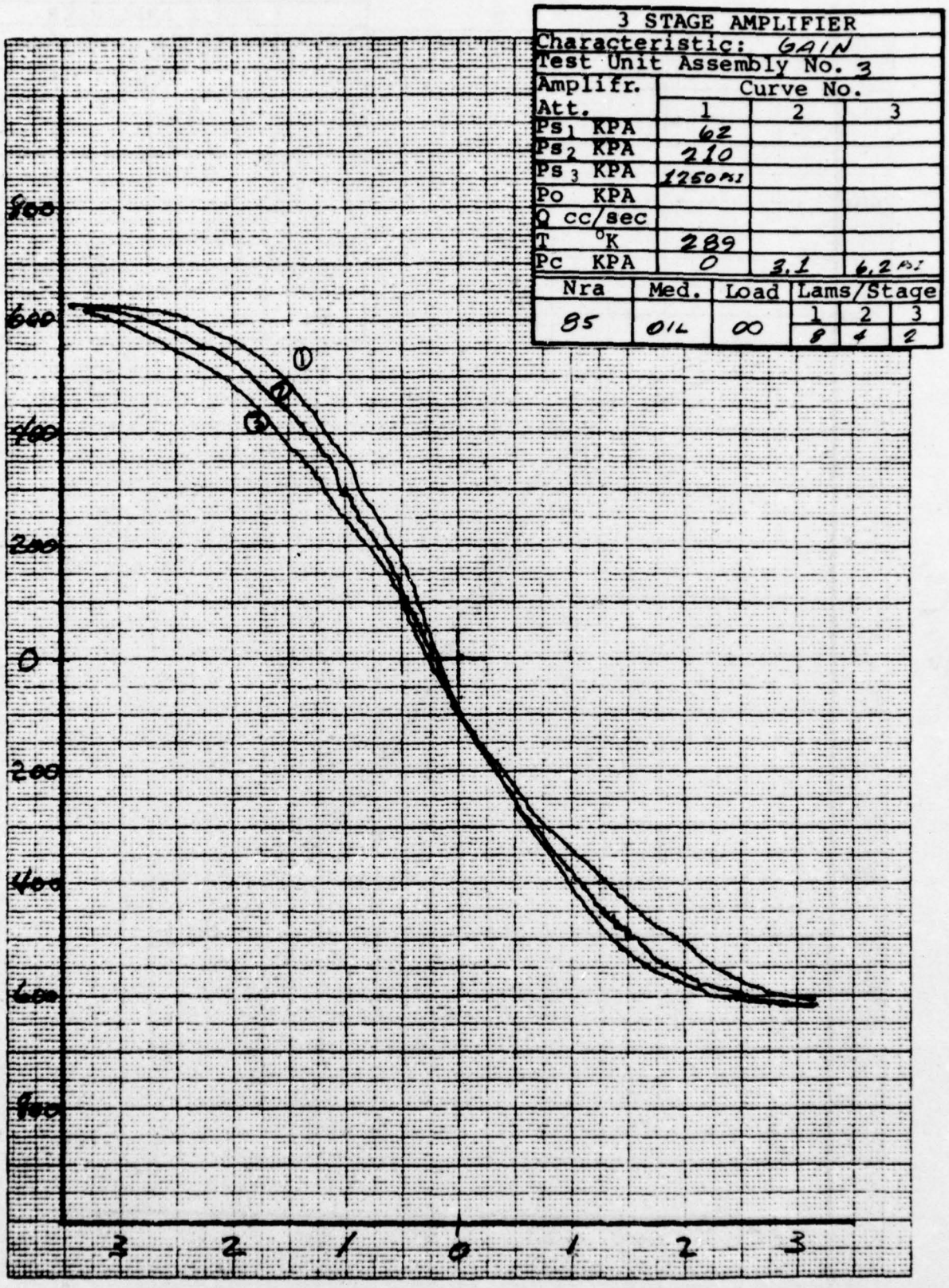

$\Delta P_3$, psi

$\Delta P_c$, psi

| 3 STAGE AMPLIFIER | | | |
|---|---|---|---|
| Characteristic: GAIN | | | |
| Test Unit Assembly No. 2 | | | |
| Amplifr. | Curve No. | | |
| Att. | 1 | 2 | 3 |
| $Ps_1$ KPA | 2.3 | | |
| $Ps_2$ KPA | 8 | | |
| $Ps_3$ KPA | 50 PSI | | |
| Po KPA | | | |
| Q cc/sec | | | |
| T °K | 330 | | |
| Pc KPA | 0 | 0.12 | 0.23 |

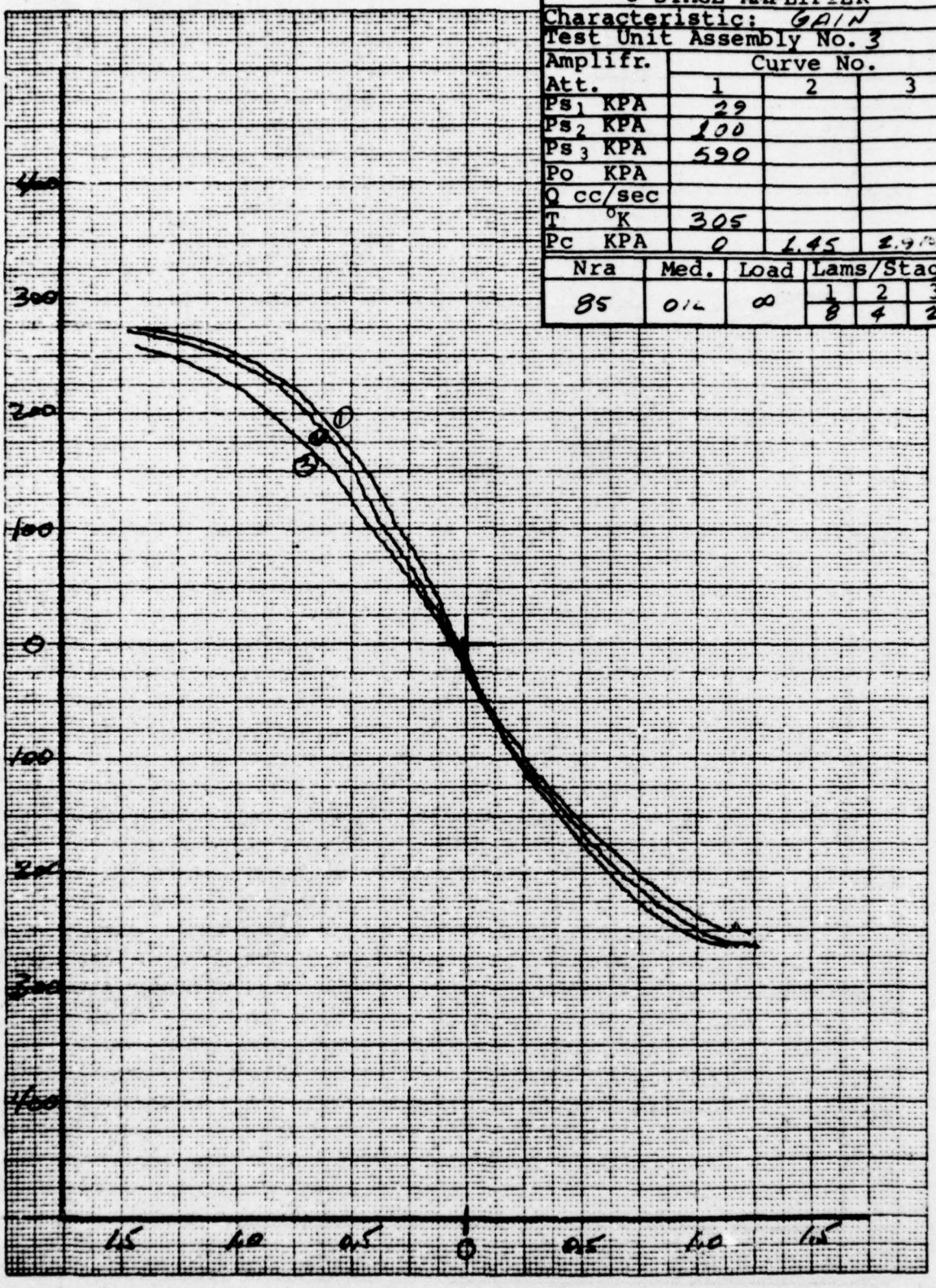
| Nra | Med. | Load | Lams/Stage | | |
|---|---|---|---|---|---|
| | | | 1 | 2 | 3 |
| 42.5 | OIL | #2 | 8 | 4 | 2 |




3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA 62
Ps2 KPA 210
Ps3 KPA 1250 PSI
Po KPA
Q cc/sec
T °K 289
Pc KPA 0 3.1 6.2 PSI
Nra 85
Med. OIL
Load ∞
Lams/Stage 1 2 3
8 4 2
800
600
400
200
0
200
400
600
800
3 2 1 0 1 2 3
ΔPo, PSI
ΔPc, PSI

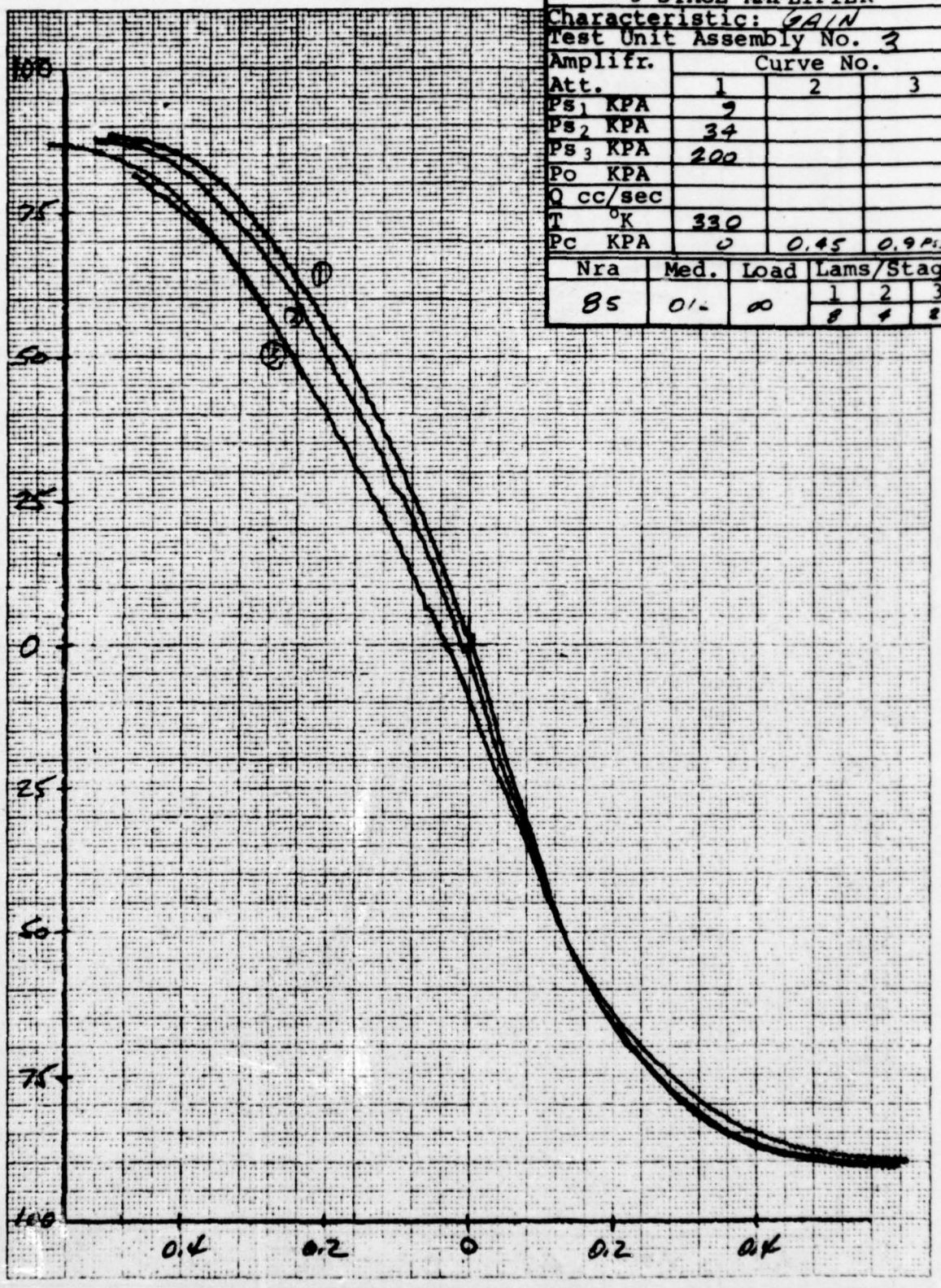
| 3 STAGE AMPLIFIER | | | |
|---|---|---|---|
| Characteristic: GAIN | | | |
| Test Unit Assembly No. 3 | | | |
| Amplifr. Att. | Curve No. 1 | 2 | 3 |
| $Ps_1$ KPA | 29 | | |
| $Ps_2$ KPA | 100 | | |
| $Ps_3$ KPA | 590 | | |
| Po KPA | | | |
| Q cc/sec | | | |
| T °K | 305 | | |
| Pc KPA | 0 | 1.45 | 2.9 |

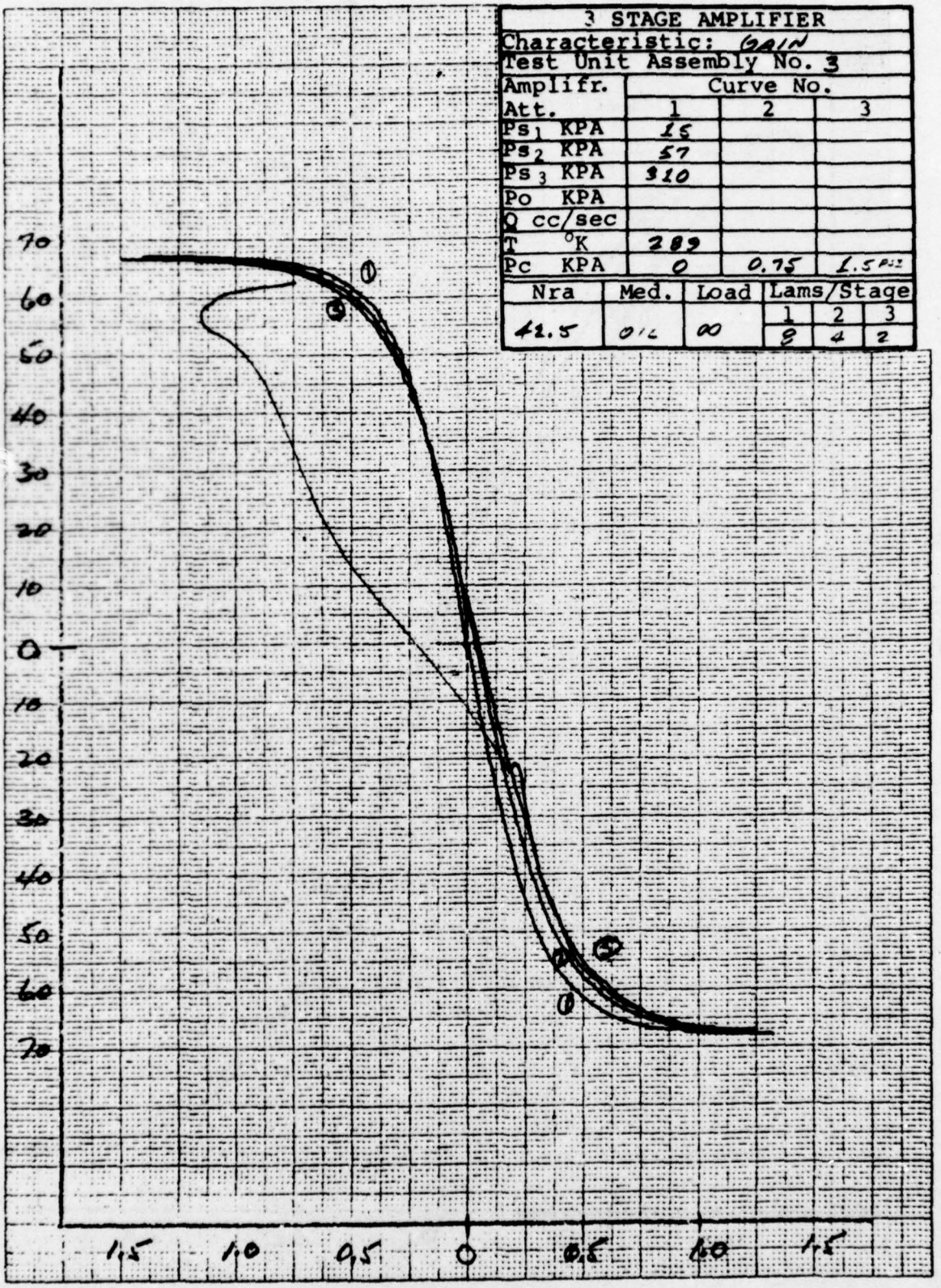
| Nra | Med. | Load | Lams/Stage 1 | 2 | 3 |
|---|---|---|---|---|---|
| 85 | Oil | ∞ | 8 | 4 | 2 |



| 3 STAGE AMPLIFIER | | | | |
|---|---|---|---|---|
| Characteristic: GAIN | | | | |
| Test Unit Assembly No. 3 | | | | |
| Amplifr. Att. | Curve No. | | | |
| | 1 | 2 | 3 | |
| $Ps_1$ KPA | 9 | | | |
| $Ps_2$ KPA | 34 | | | |
| $Ps_3$ KPA | 200 | | | |
| Po KPA | | | | |
| Q cc/sec | | | | |
| T °K | 330 | | | |
| Pc KPA | 0 | 0.45 | 0.9 PSI | |

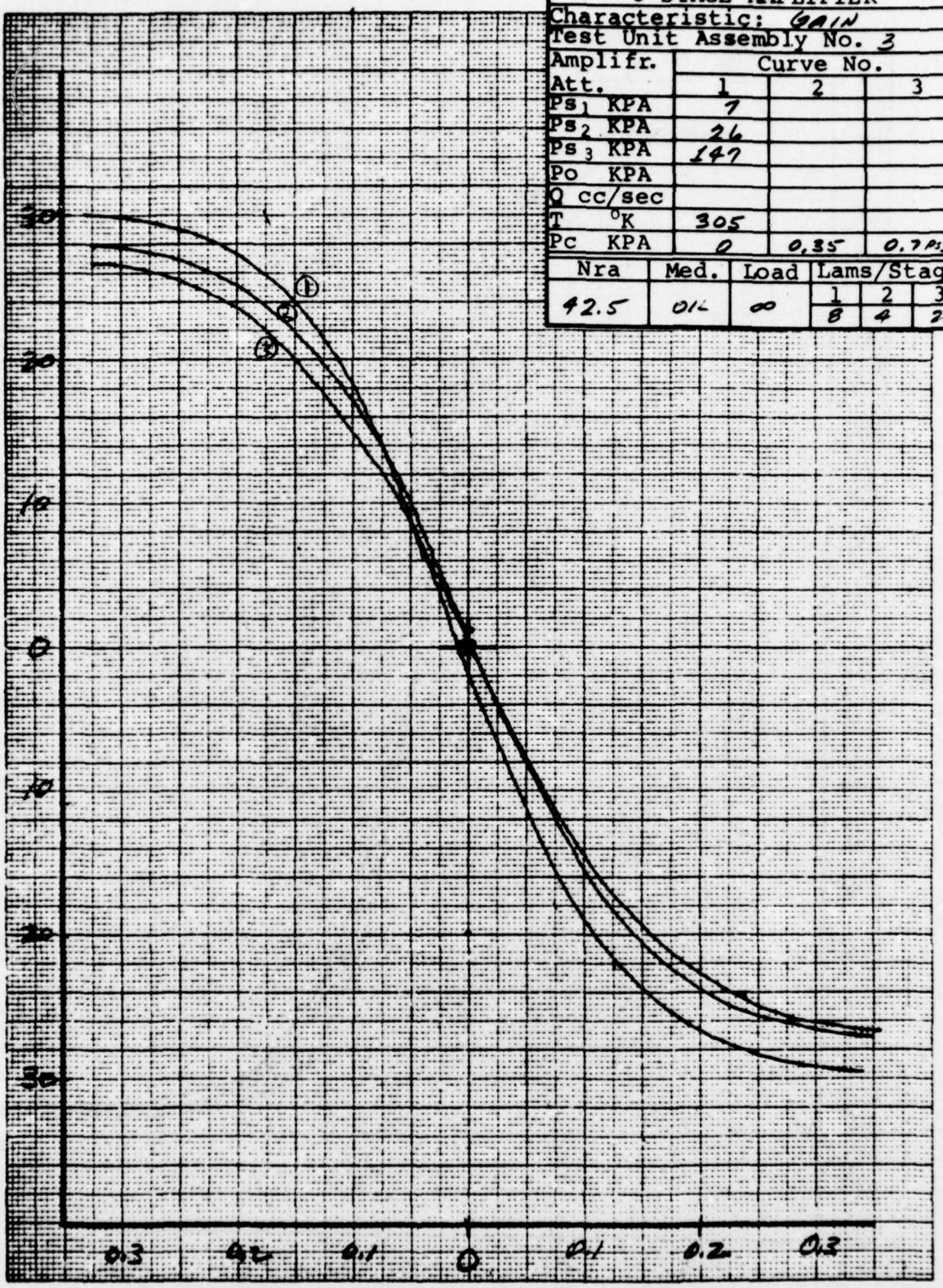
| Nra | Med. | Load | Lams/Stage | | |
|---|---|---|---|---|---|
| | | | 1 | 2 | 3 |
| 85 | 01- | ∞ | 8 | 4 | 2 |

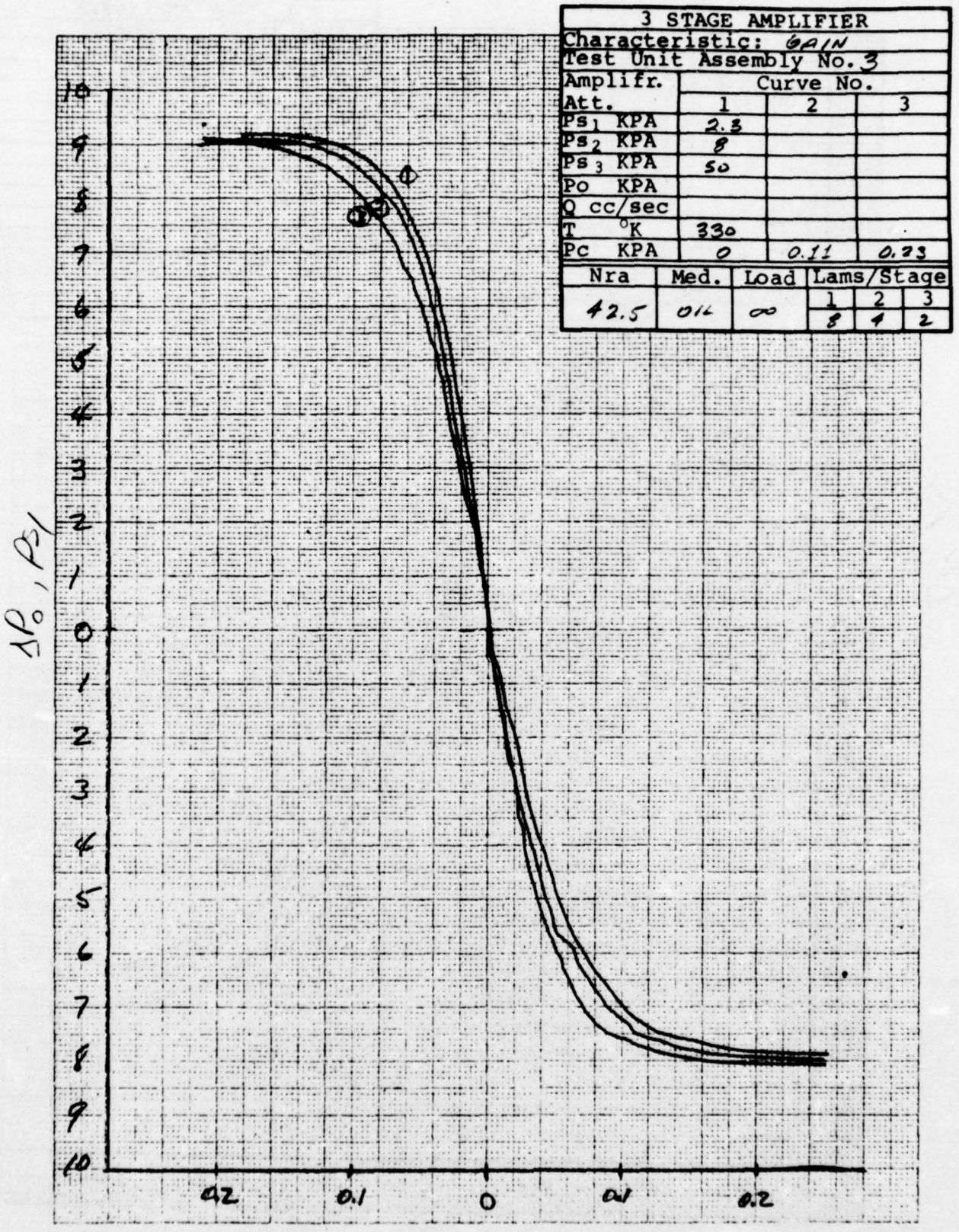


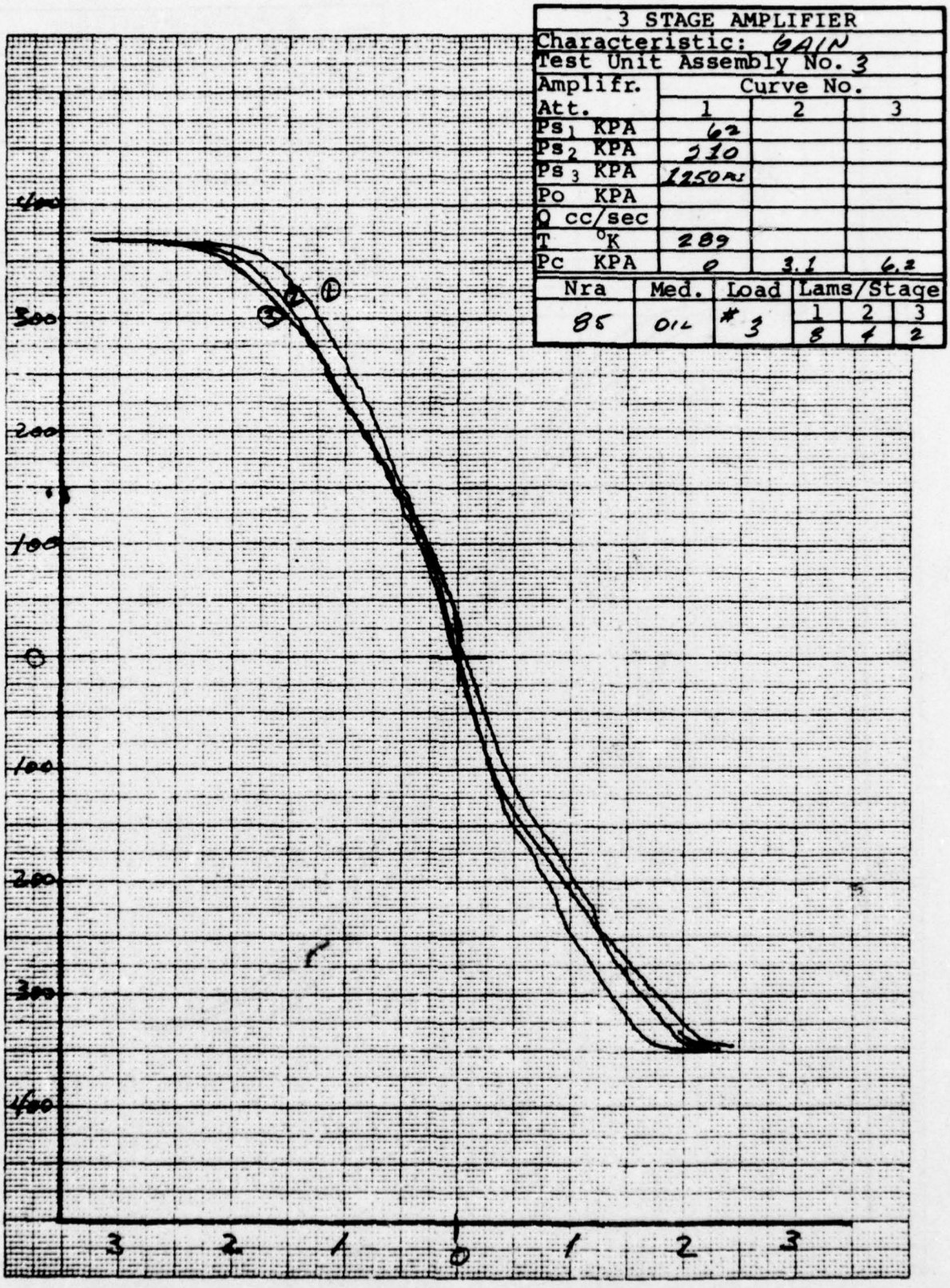

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA 15
Ps2 KPA 57
Ps3 KPA 310
Po KPA
Q cc/sec
T °K 289
Pc KPA 0 0.75 1.5 PSI
Nra Med. Load Lams/Stage 1 2 3
42.5 0% ∞ 8 4 2
70
60
50
40
30
20
10
0
10
20
30
40
50
60
70
1.5
1.0
0.5
0
0.5
1.0
1.5
ΔPo, PSI
ΔPc, PSI

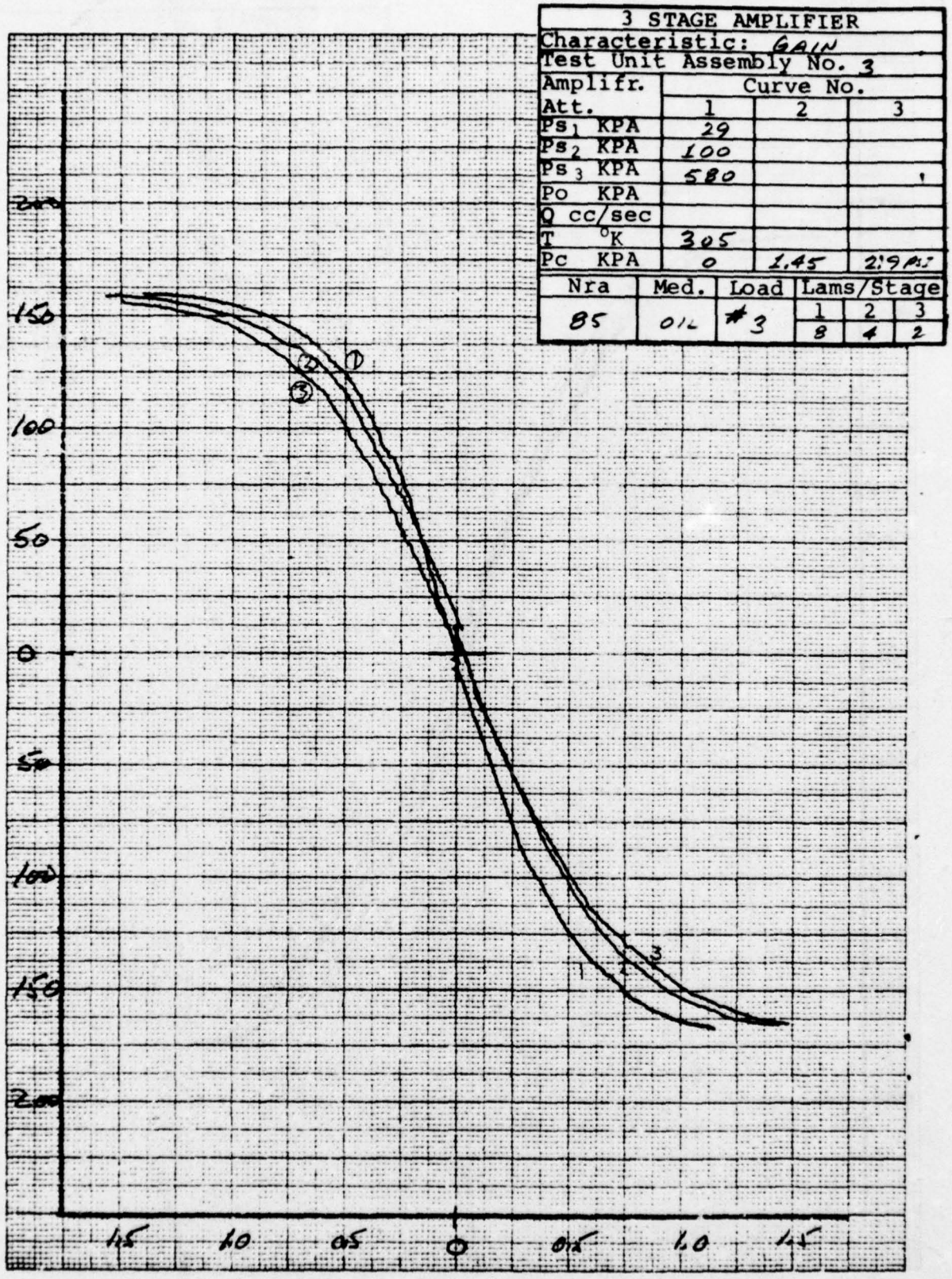
| 3 STAGE AMPLIFIER | | | |
|---|---|---|---|
| Characteristic: GAIN | | | |
| Test Unit Assembly No. 3 | | | |
| Amplifr. Att. | Curve No. 1 | 2 | 3 |
| $Ps_1$ KPA | 7 | | |
| $Ps_2$ KPA | 26 | | |
| $Ps_3$ KPA | 147 | | |
| Po KPA | | | |
| Q cc/sec | | | |
| T °K | 305 | | |
| Pc KPA | 0 | 0,35 | 0.7 PSI |

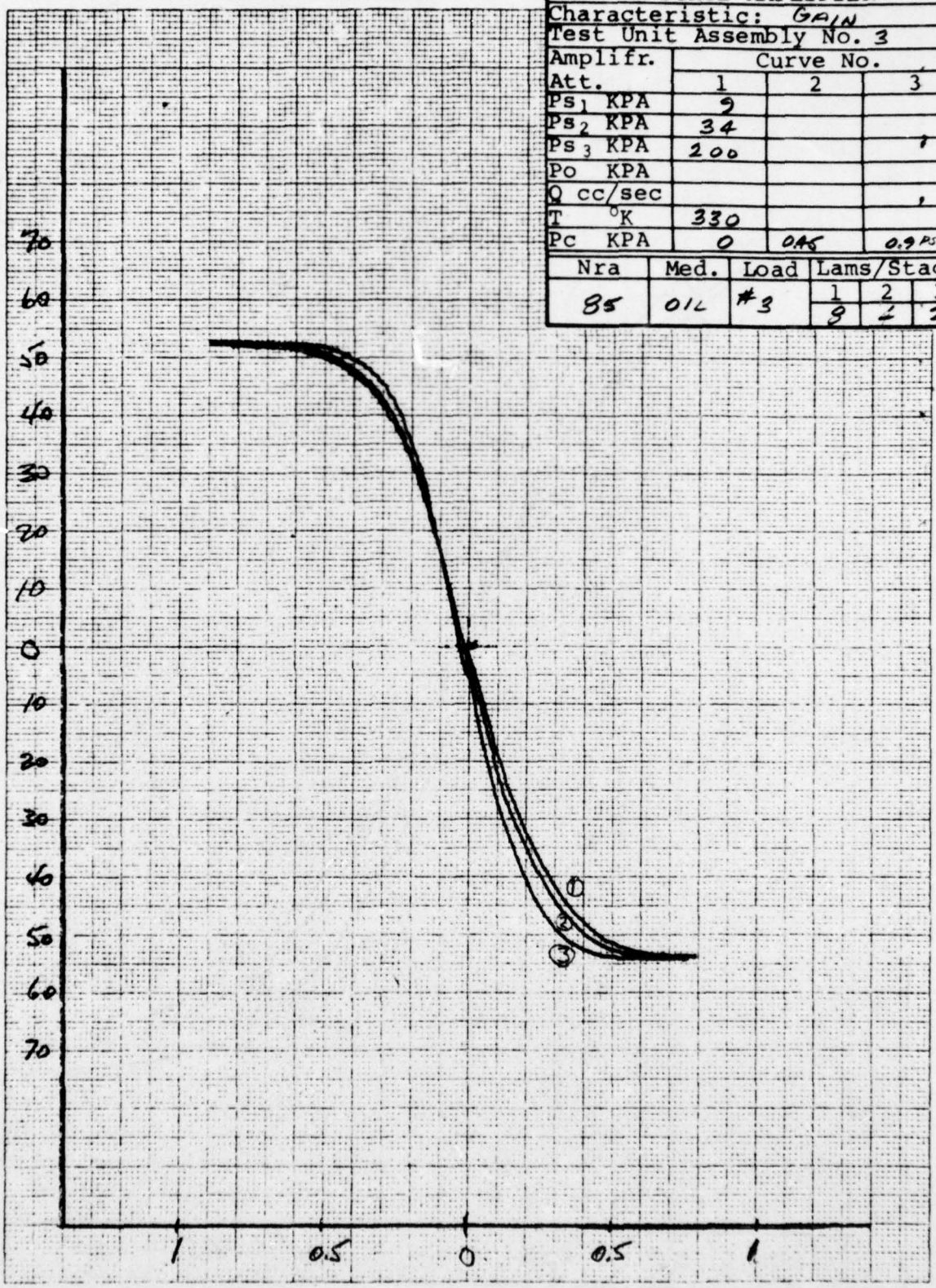
| Nra | Med. | Load | Lams/Stage 1 | 2 | 3 |
|---|---|---|---|---|---|
| 42.5 | Oil | ∞ | 8 | 4 | 2 |

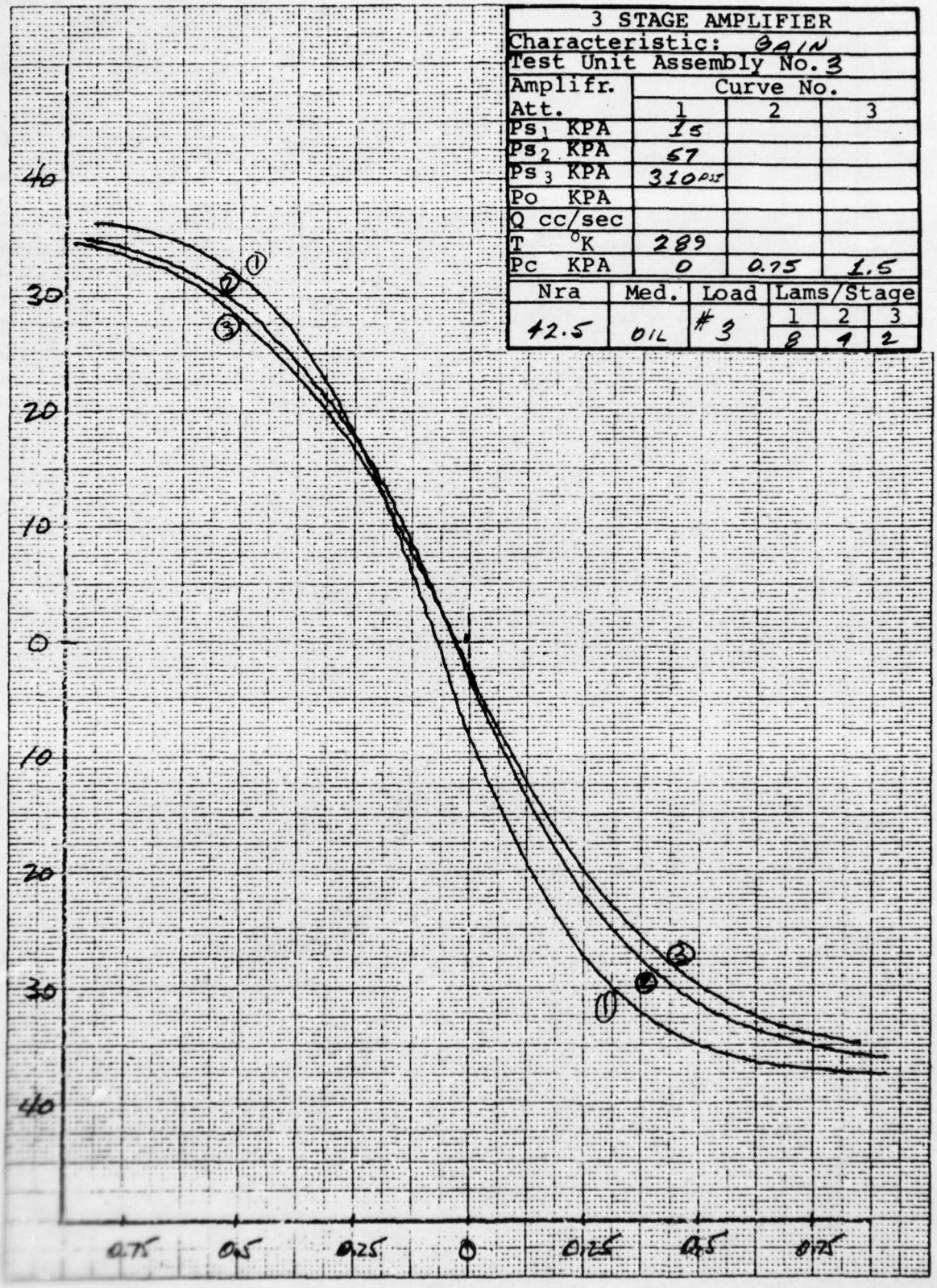



3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA 2.3
Ps2 KPA 8
Ps3 KPA 50
Po KPA
Q cc/sec
T °K 330
Pc KPA 0 0.11 0.23
Nra 42.5
Med. Oil
Load ∞
Lams/Stage 1 2 3 / 8 4 2
ΔPo, Psi
ΔPc, Psi
0.2
0.1
0
0.1
0.2


3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA 62
Ps2 KPA 210
Ps3 KPA 1250 PSI
Po KPA
Q cc/sec
T °K 289
Pc KPA 0 3.1 6.2
Nra 85
Med. OIL
Load #3
Lams/Stage 1 2 3 8 4 2
400
300
200
100
0
100
200
300
400
3 2 1 0 1 2 3
ΔPo, PSI
ΔPc, PSI

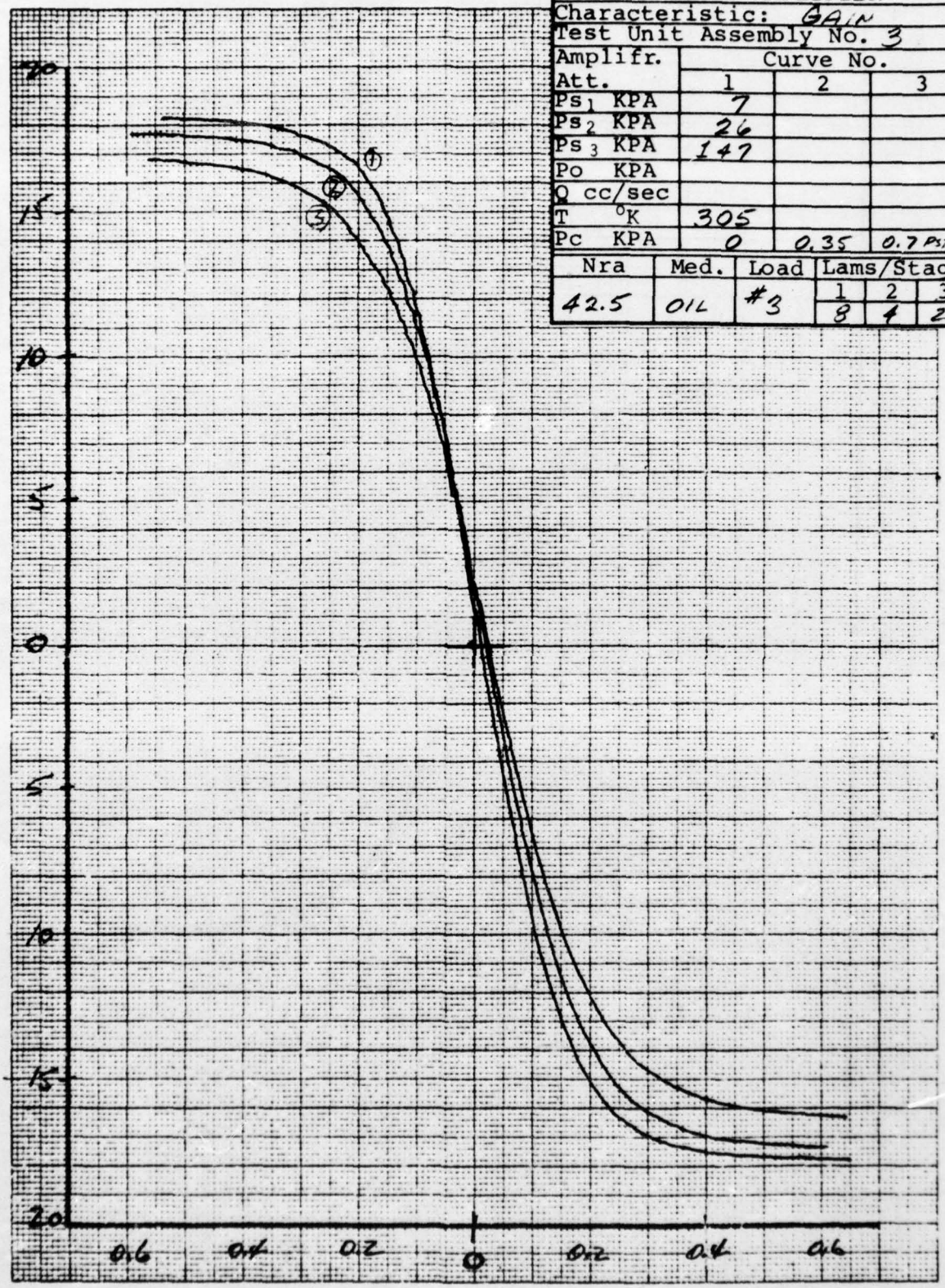

3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Att.
Curve No.
1 2 3
Ps1 KPA 29
Ps2 KPA 100
Ps3 KPA 580
Po KPA
Q cc/sec
T °K 305
Pc KPA 0 1.45 2.9 P.S.
Nra Med. Load Lams/Stage
85 OIL #3 1 2 3
8 4 2
150
100
50
0
50
100
150
200
1.5 1.0 0.5 0 0.5 1.0 1.5
ΔPo, psi
ΔPc, psi


3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA 9
Ps2 KPA 34
Ps3 KPA 200
Po KPA
Q cc/sec
T °K 330
Pc KPA 0 0.45 0.9 PSI
Nra 85
Med. OIL
Load #3
Lams/Stage 1 9 2 2 3 2
70 60 50 40 30 20 10 0 10 20 30 40 50 60 70
1 0.5 0 0.5 1
ΔPo, psi
ΔPc, psi
1
2
3


3 STAGE AMPLIFIER
Characteristic: GAIN
Test Unit Assembly No. 3
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA 15
Ps2 KPA 57
Ps3 KPA 310 PSI
Po KPA
Q cc/sec
T °K 289
Pc KPA 0 0.75 1.5
Nra 42.5
Med. OIL
Load #3
Lams/Stage 1 2 3
8 1 2
40
30
20
10
0
10
20
30
40
0.75
0.5
0.25
0
0.25
0.5
0.75
ΔPo, PSI
ΔPc, PSI

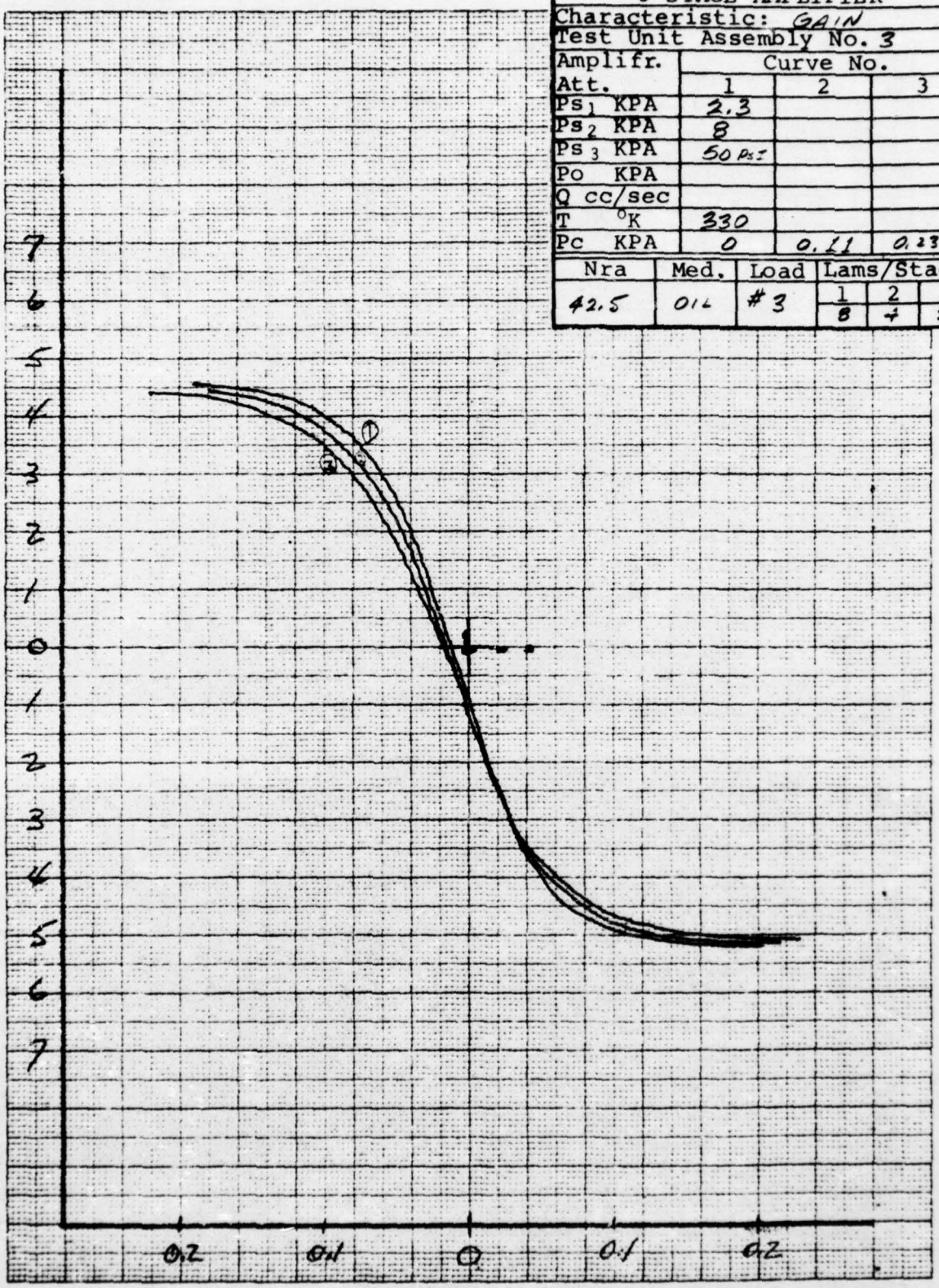
| 3 STAGE AMPLIFIER | | | |
|---|---|---|---|
| Characteristic: GAIN | | | |
| Test Unit Assembly No. 3 | | | |
| Amplifr. Att. | Curve No. 1 | 2 | 3 |
| $Ps_1$ KPA | 7 | | |
| $Ps_2$ KPA | 26 | | |
| $Ps_3$ KPA | 147 | | |
| Po KPA | | | |
| Q cc/sec | | | |
| T °K | 305 | | |
| Pc KPA | 0 | 0.35 | 0.7 PSI |

| Nra | Med. | Load | Lams/Stage 1 | 2 | 3 |
|---|---|---|---|---|---|
| 42.5 | OIL | #3 | 8 | 4 | 2 |

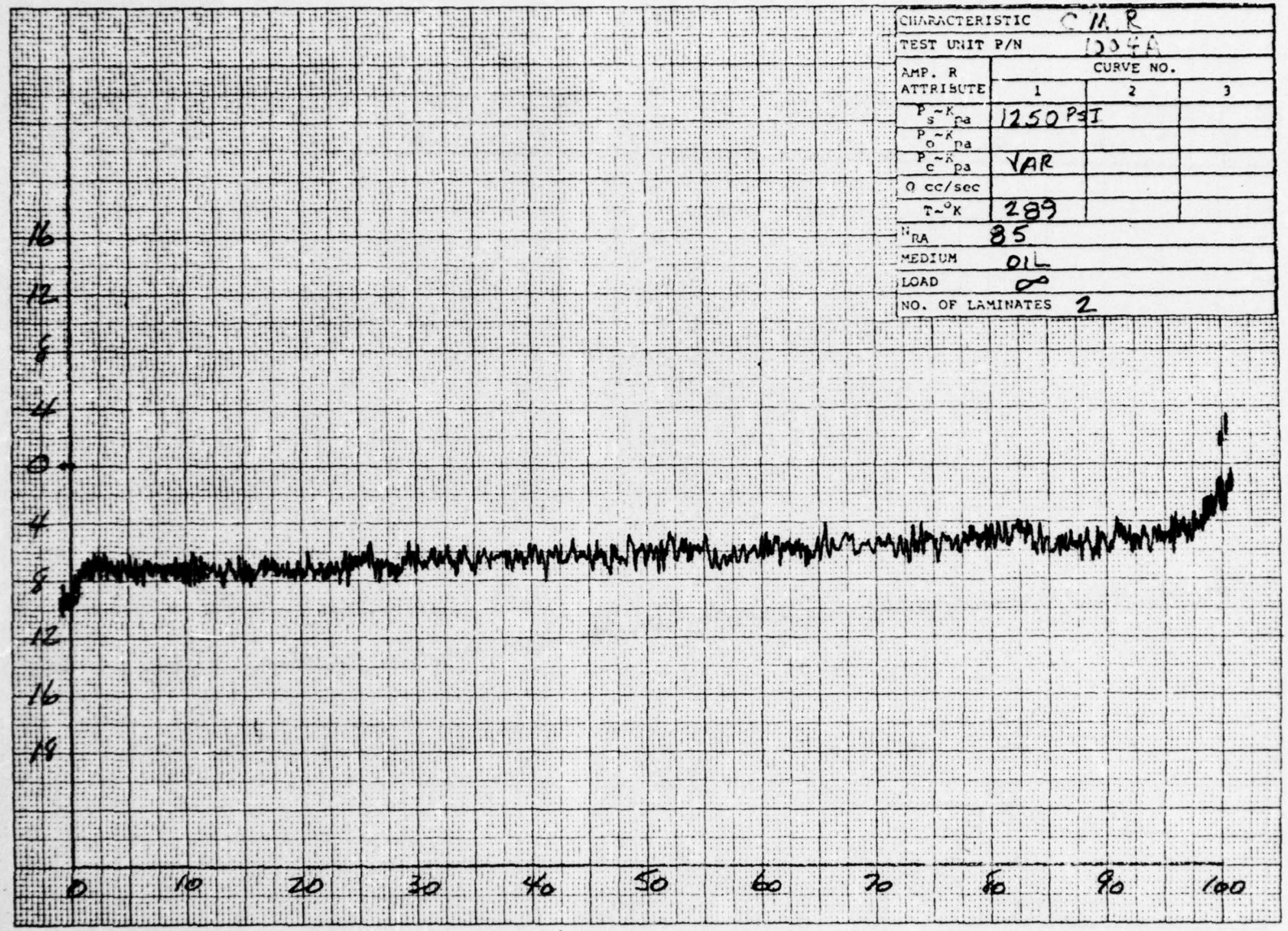


| 3 STAGE AMPLIFIER | | | |
|---|---|---|---|
| Characteristic: GAIN | | | |
| Test Unit Assembly No. 3 | | | |
| Amplifr. Att. | Curve No. 1 | 2 | 3 |
| $Ps_1$ KPA | 2.3 | | |
| $Ps_2$ KPA | 8 | | |
| $Ps_3$ KPA | 50 psi | | |
| Po KPA | | | |
| Q cc/sec | | | |
| T °K | 330 | | |
| Pc KPA | 0 | 0.11 | 0.23 |

| Nra | Med. | Load | Lams/Stage 1 | 2 | 3 |
|---|---|---|---|---|---|
| 42.5 | 014 | #3 | 8 | 4 | 2 |



| CHARACTERISTIC | C 11 R | | |
|---|---|---|---|
| TEST UNIT P/N | 1004A | | |
| AMP. R ATTRIBUTE | CURVE NO. 1 | 2 | 3 |
| $P_s$~$K_{pa}$ | 1250 PSI | | |
| $P_o$~$K_{pa}$ | | | |
| $P_c$~$K_{pa}$ | VAR | | |
| 0 cc/sec | | | |
| T~°K | 289 | | |
| $N_{RA}$ | 85 | | |
| MEDIUM | OIL | | |
| LOAD | ∞ | | |
| NO. OF LAMINATES | 2 | | |

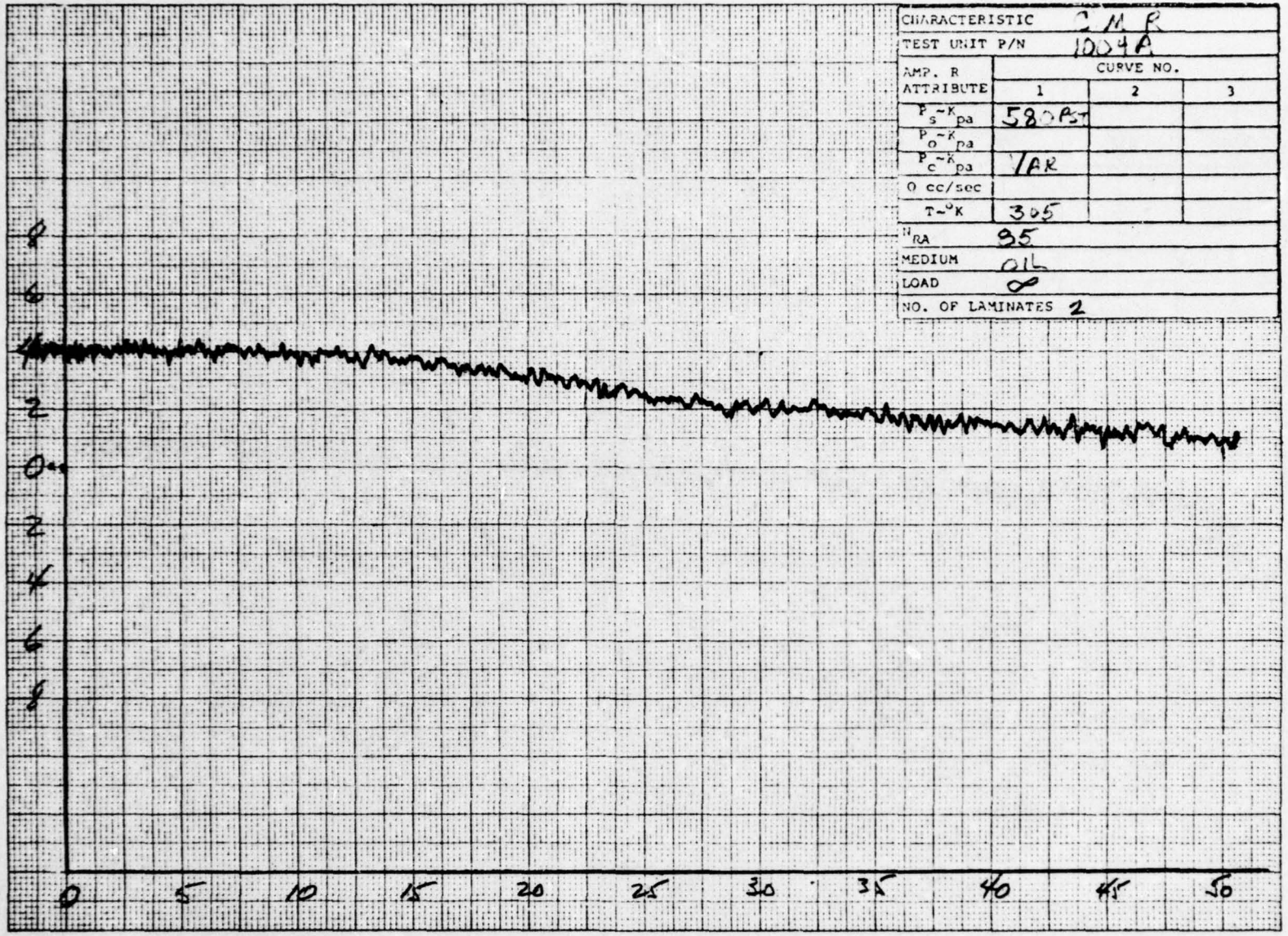


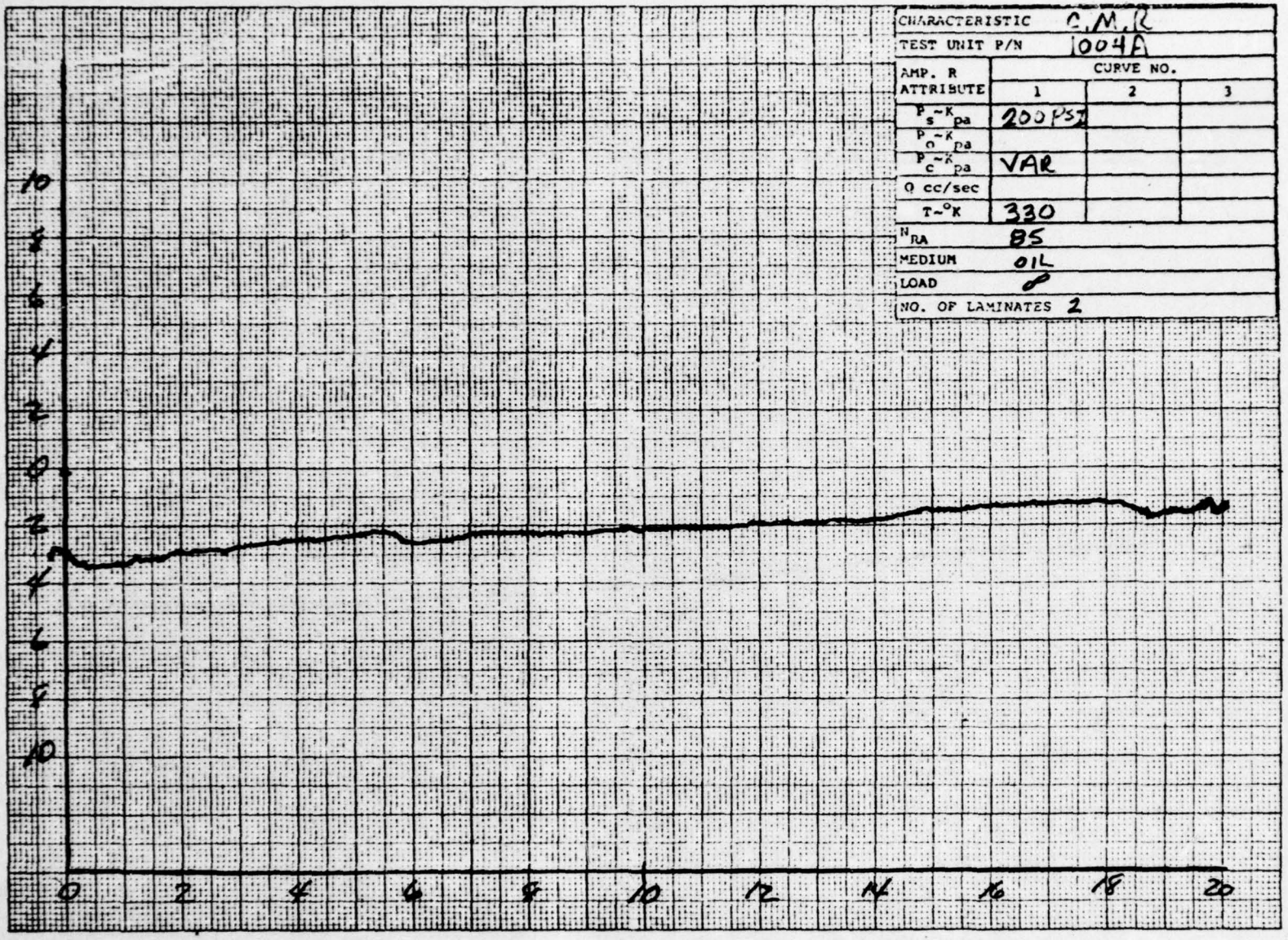

$\Delta P_o$, psi

$P_c$, psi

469

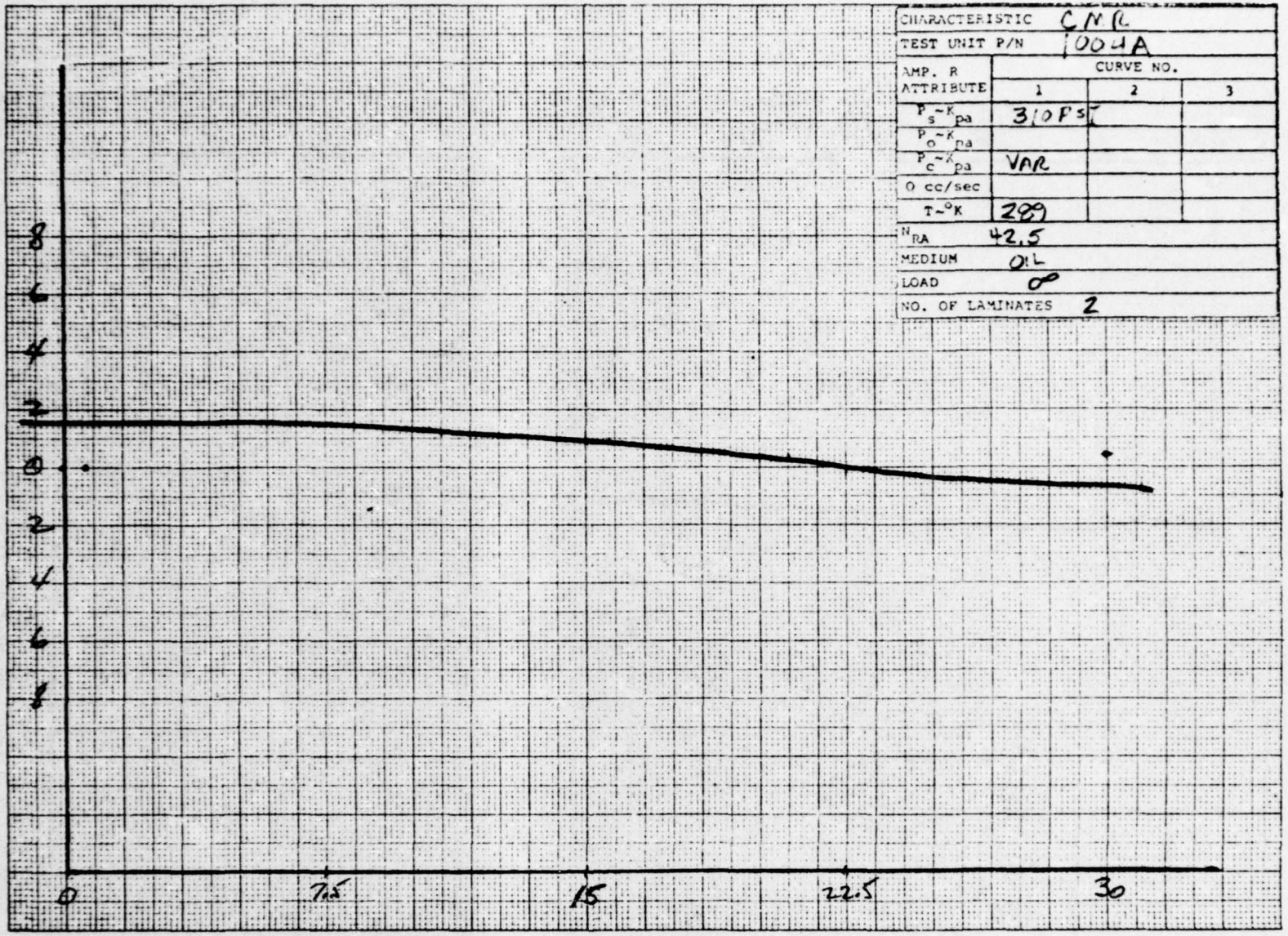
CLEVELAND CHART

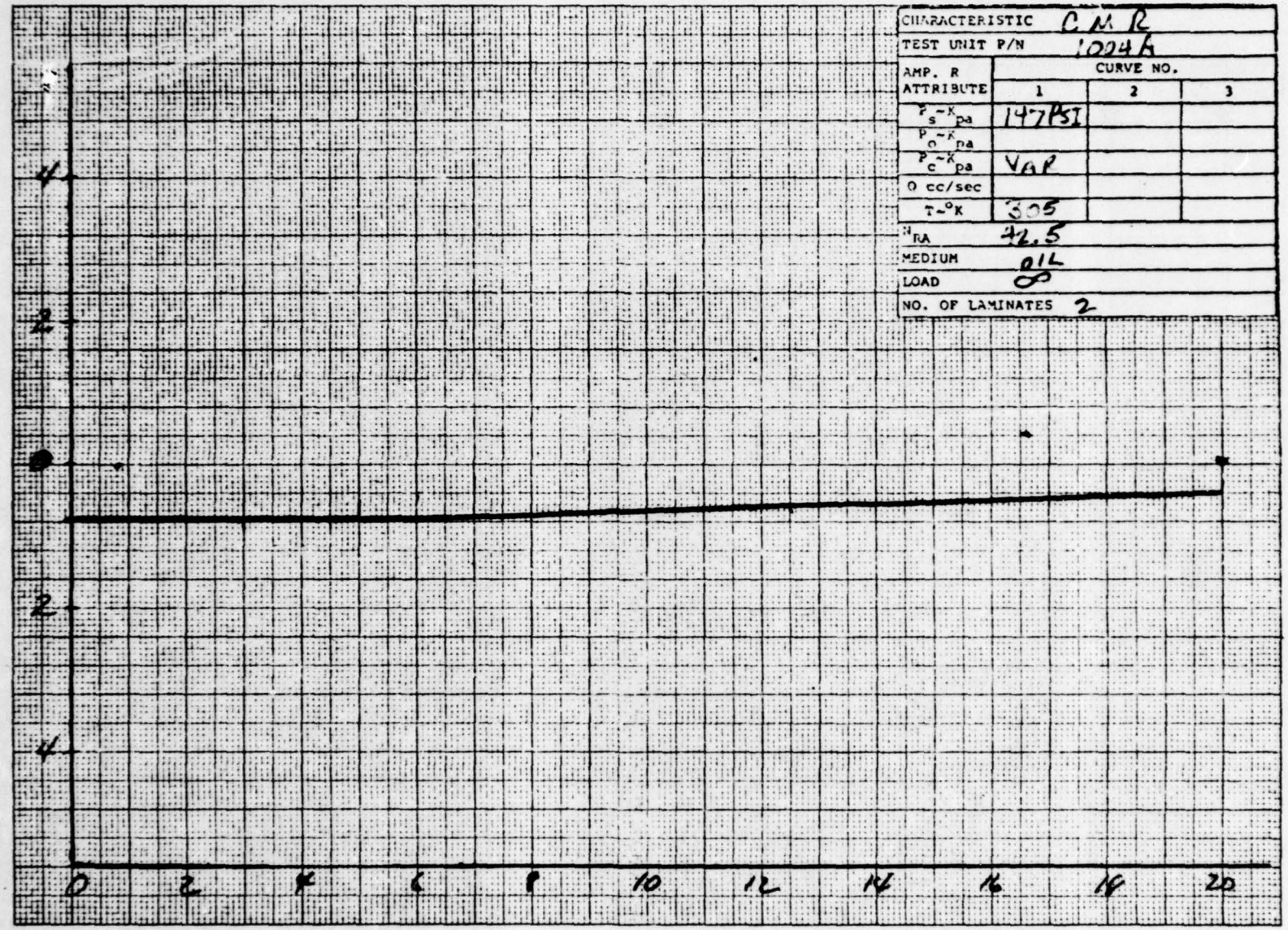

CHARACTERISTIC C M R
TEST UNIT P/N 1004A
AMP. R
ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa 580 PSI
$P_o$~Kpa
$P_c$~Kpa VAR
0 cc/sec
T~°K 305
$N_{RA}$ 95
MEDIUM OIL
LOAD ∞
NO. OF LAMINATES 2
8
6
4
2
0
2
4
6
8
0
5
10
15
20
25
30
35
40
45
50
$P_C$, PSI
$\Delta P_o$, PSI
470




471

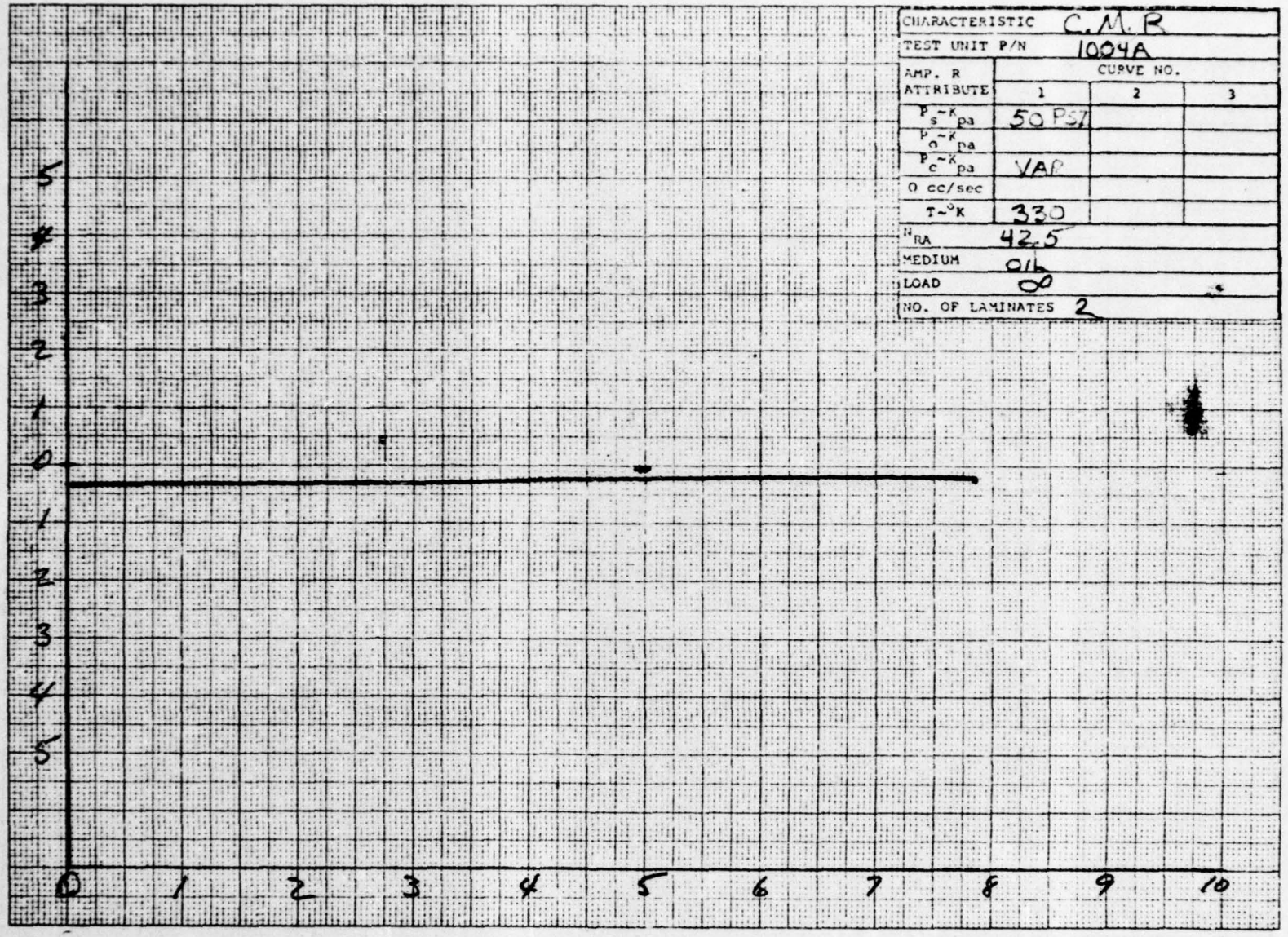
$\Delta P_o$, PSI


CHARACTERISTIC CNL
TEST UNIT P/N 1004A
AMP. R
ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa 310 PSI
$P_o$~Kpa
$P_c$~Kpa VAR
0 cc/sec
T~°K 289
$N_{RA}$ 42.5
MEDIUM OIL
LOAD ∞
NO. OF LAMINATES 2
8
6
4
2
0
2
4
6
8
0
7.5
15
22.5
30
$P_c$, psi
$\Delta P_o$, psi
472

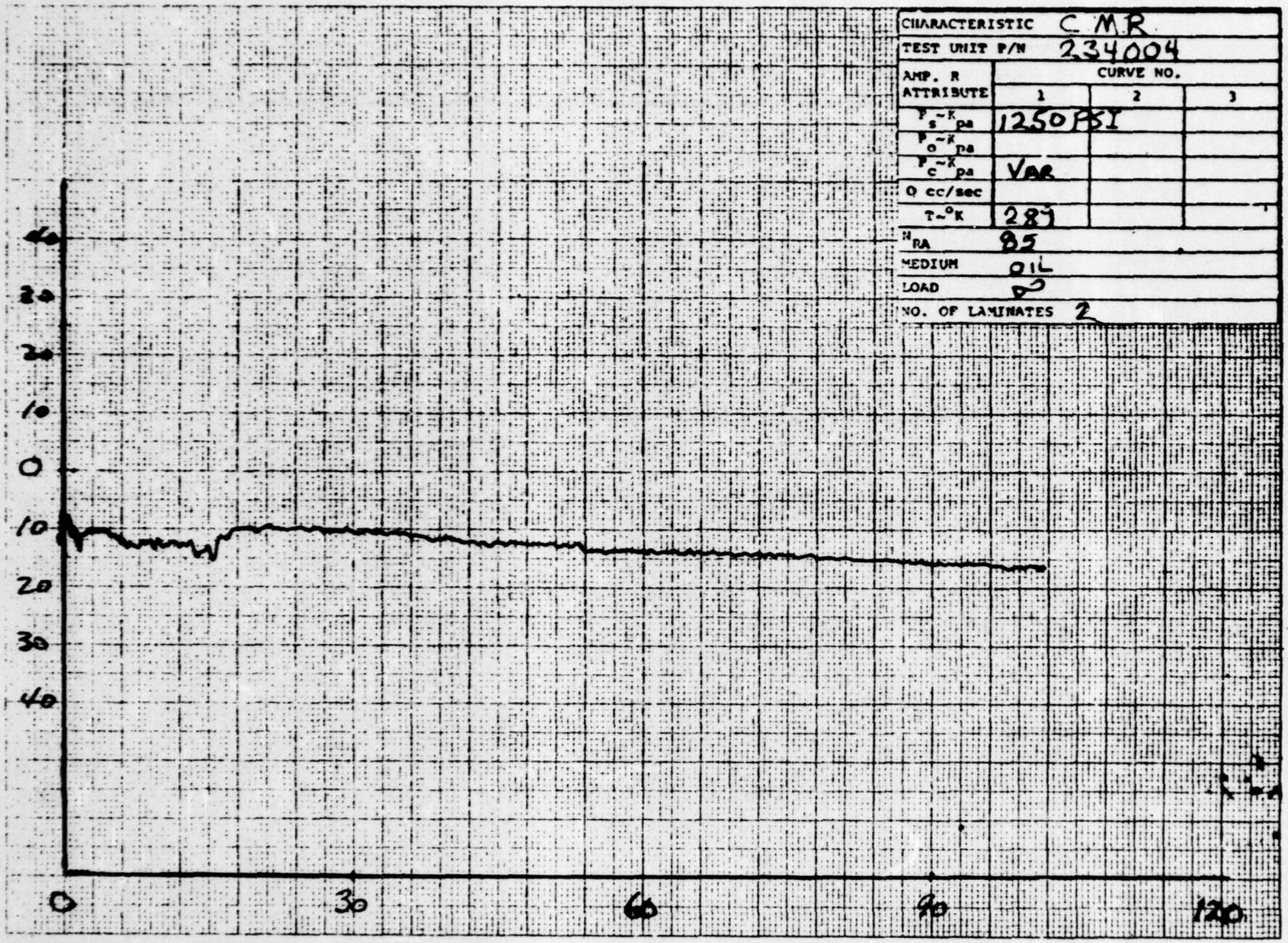


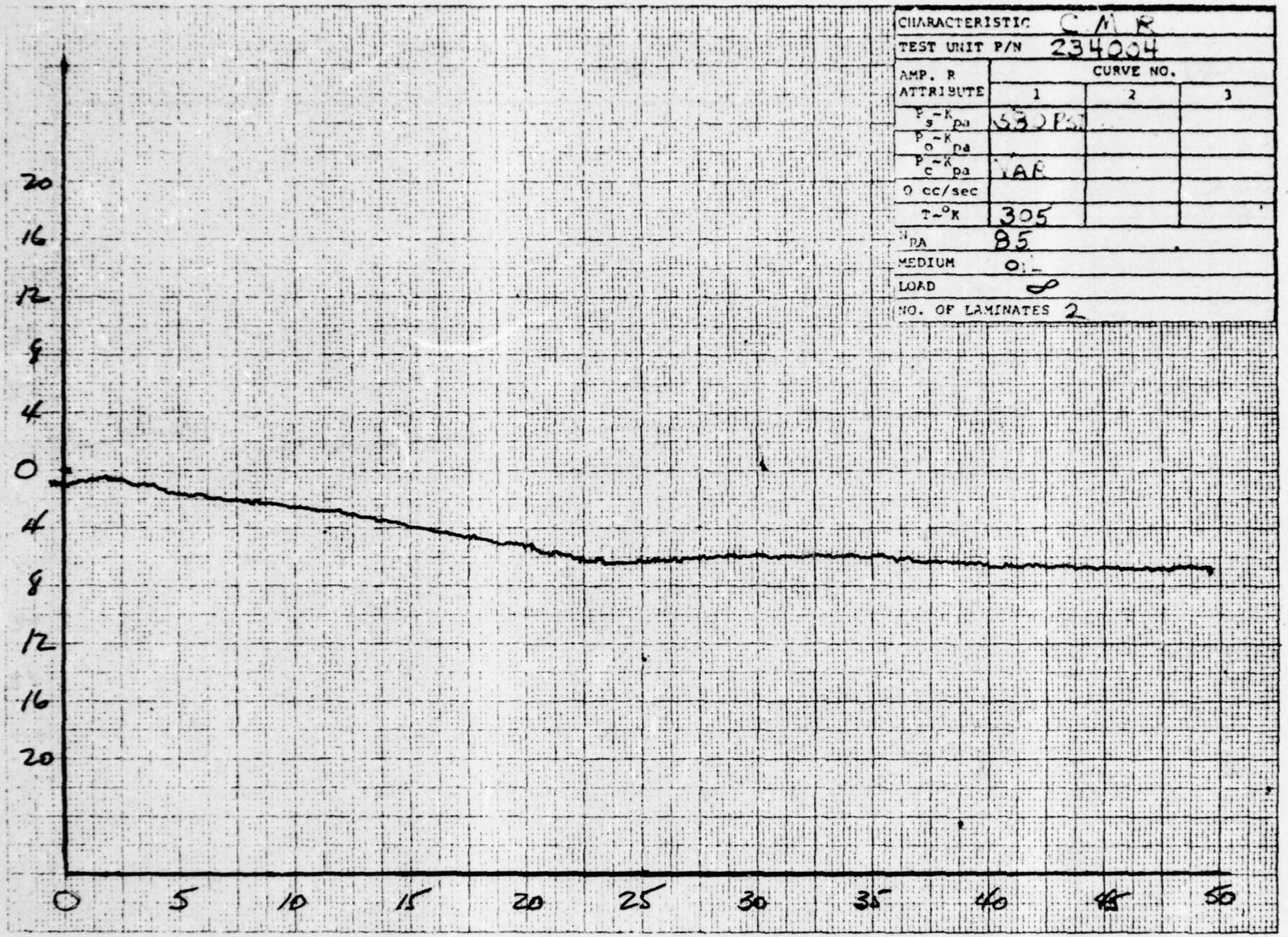

$\Delta P_o$, psi

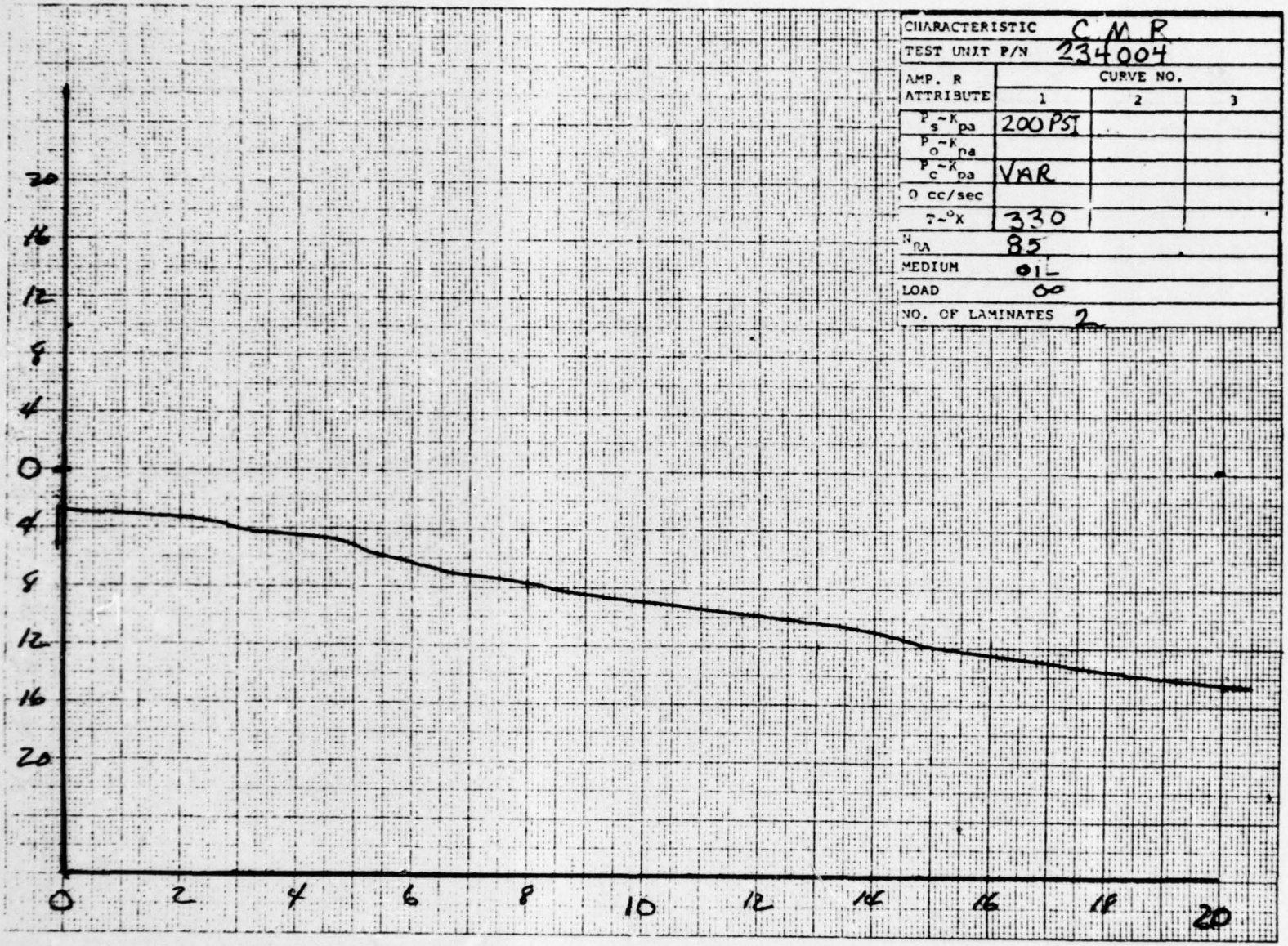
$P_c$, psi

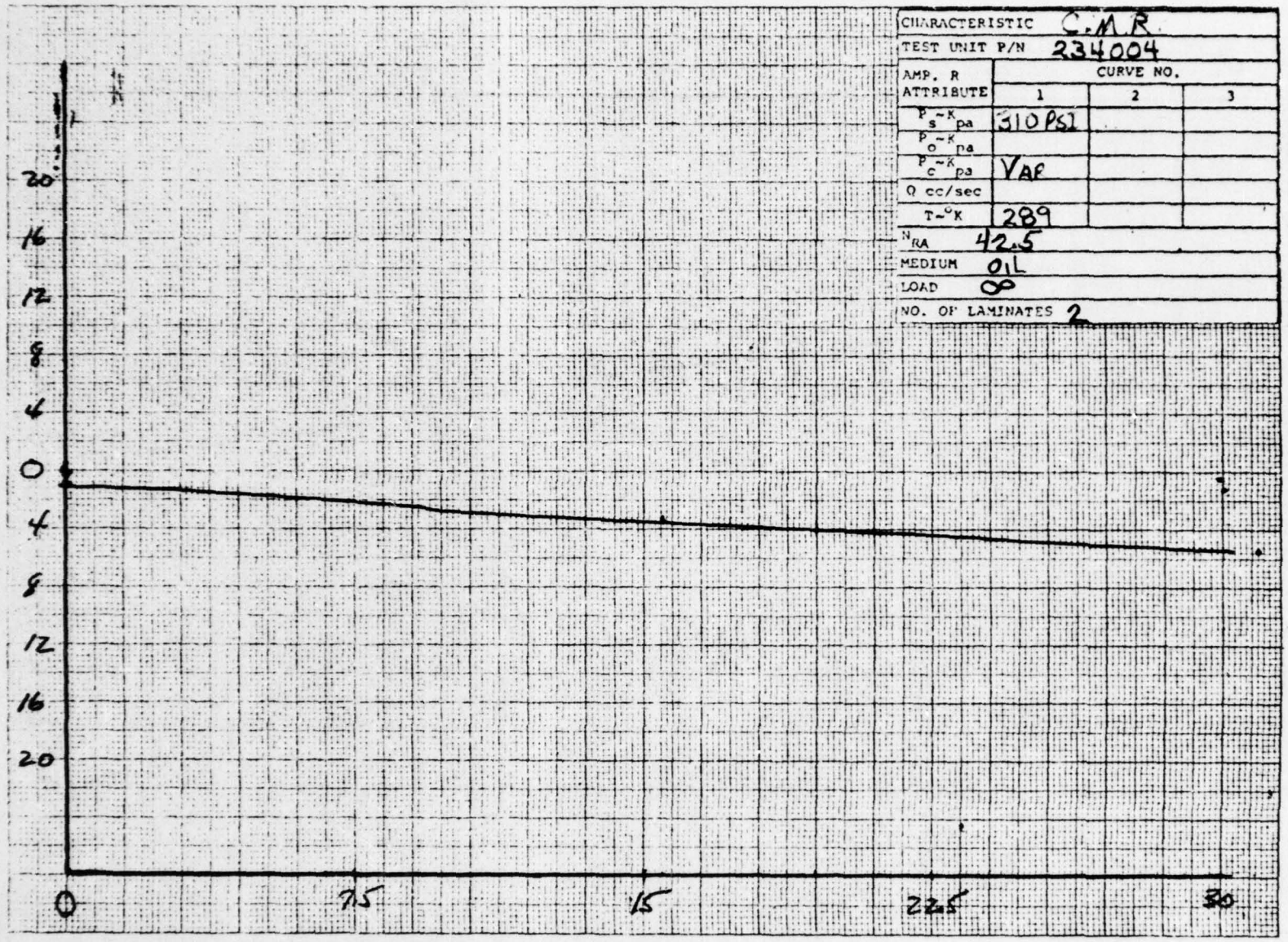


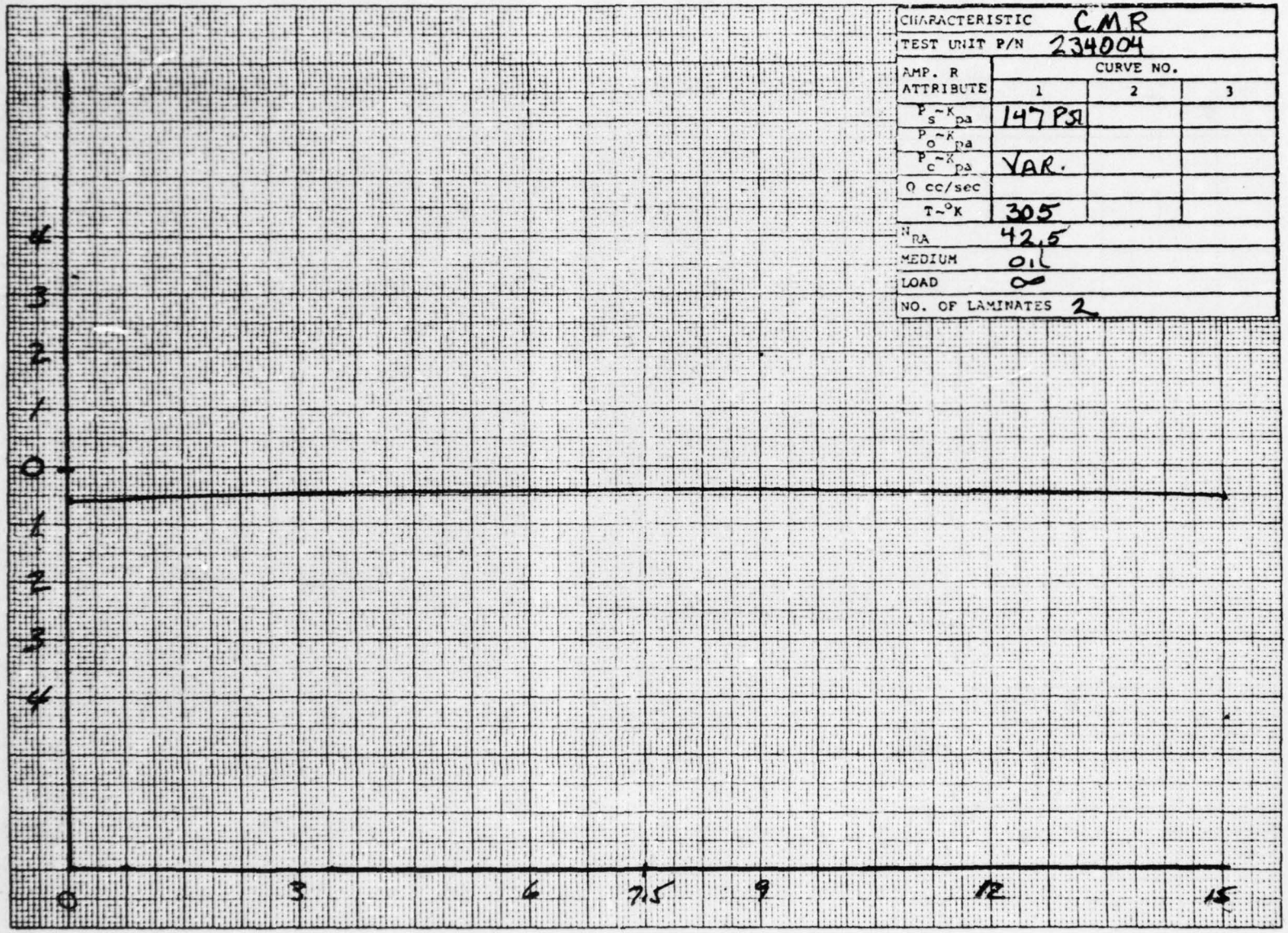

CHARMHILL CHARTS


CHARACTERISTIC CMR
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K psa 1250 PSI
$P_o$~K psa
$P_c$~K psa VAC
Q cc/sec
T~°K 289
$N_{RA}$ 85
MEDIUM OIL
LOAD
NO. OF LAMINATES 2
40
20
10
0
10
20
30
40
0
30
60
90
120
$\Delta P_o$, psi
$P_c$, psi


CHARACTERISTIC C M R
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa 530 PSI
$P_o$~K pa
$P_c$~K pa AR
0 cc/sec
T~°K 305
$N_{PA}$ 85
MEDIUM O2
LOAD 8
NO. OF LAMINATES 2
20 16 12 8 4 0 4 8 12 16 20
0 5 10 15 20 25 30 35 40 45 50
$\Delta P_s$, psi
$P_c$, psi

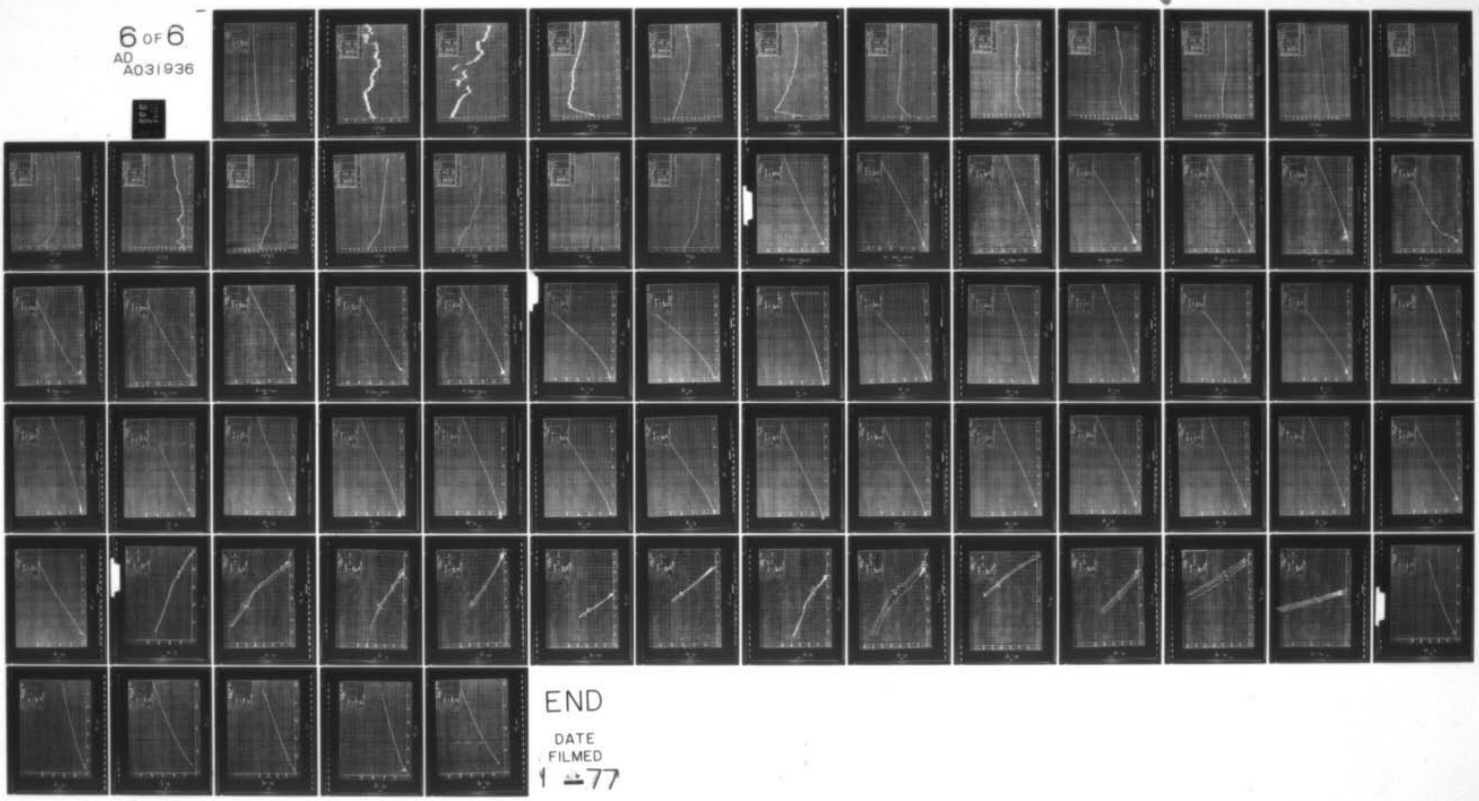

CHARACTERISTIC C M R
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~$K_{pa}$ 200 PSI
$P_o$~$K_{pa}$
$P_c$~$K_{pa}$ VAR
0 cc/sec
T~°K 330
$N_{RA}$ 85
MEDIUM OIL
LOAD ∞
NO. OF LAMINATES 2
20
16
12
8
4
0
4
8
12
16
20
0
2
4
6
8
10
12
14
16
18
20
$\Delta P_o$, psi
$P_c$, psi


CHARACTERISTIC C.M.R.
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa 310 PSI
$P_o$~K pa
$P_c$~K pa VAR
Q cc/sec
T~°K 289
$N_{RA}$ 42.5
MEDIUM OIL
LOAD ∞
NO. OF LAMINATES 2
20 16 12 8 4 0 4 8 12 16 20
0 7.5 15 22.5 30
$\Delta P_o$, psi
$P_c$, psi


CHARACTERISTIC CMR
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa 147 PSI
$P_o$~K pa
$P_c$~K pa VAR.
0 cc/sec
T~°K 305
$N_{RA}$ 42.5
MEDIUM oil
LOAD ∞
NO. OF LAMINATES 2
4
3
2
1
0
1
2
3
4
0
3
6
7.5
9
12
15
ΔP₀, PSI
Pc ; PSI

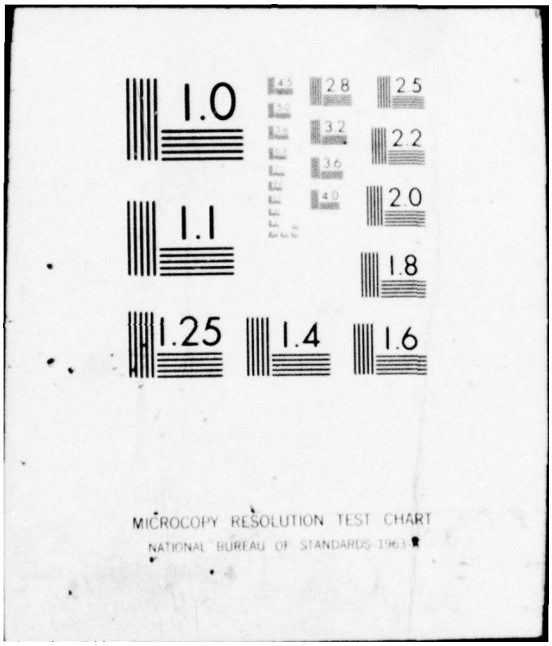
AD-A031 936 AIRESEARCH MFG CO OF ARIZONA PHOENIX F/G 20/4
ENVIRONMENTAL TEST PROGRAM FOR EVALUATION OF FLUIDIC ELEMENTS F--ETC(U)
DEC 75 M F CYCON, T G SUTTON, H R GAMBLE DAAG39-74-C-0187
UNCLASSIFIED 75-411145 HDL-CR-75-187-1 NL

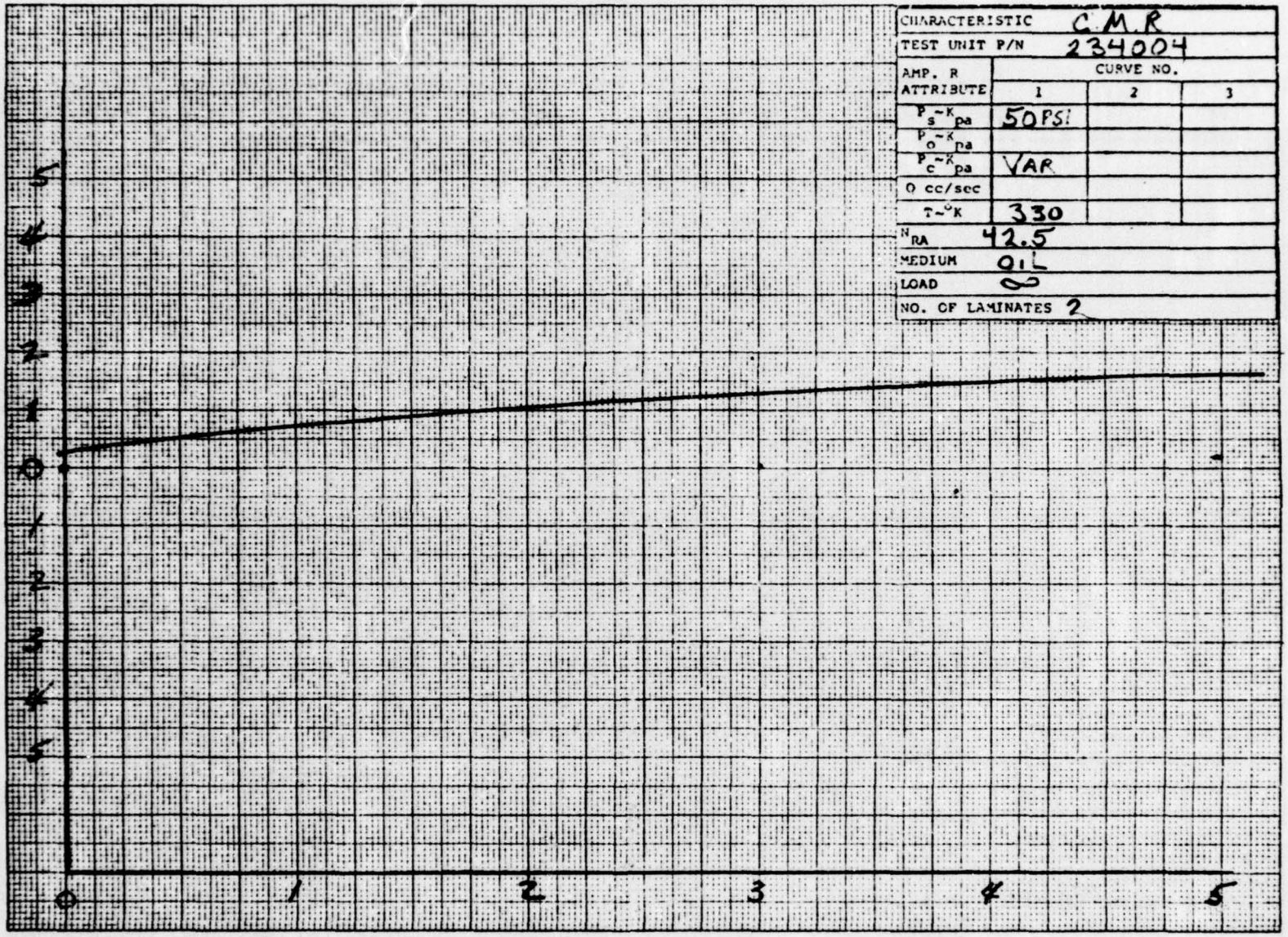
6 OF 6
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1 -77

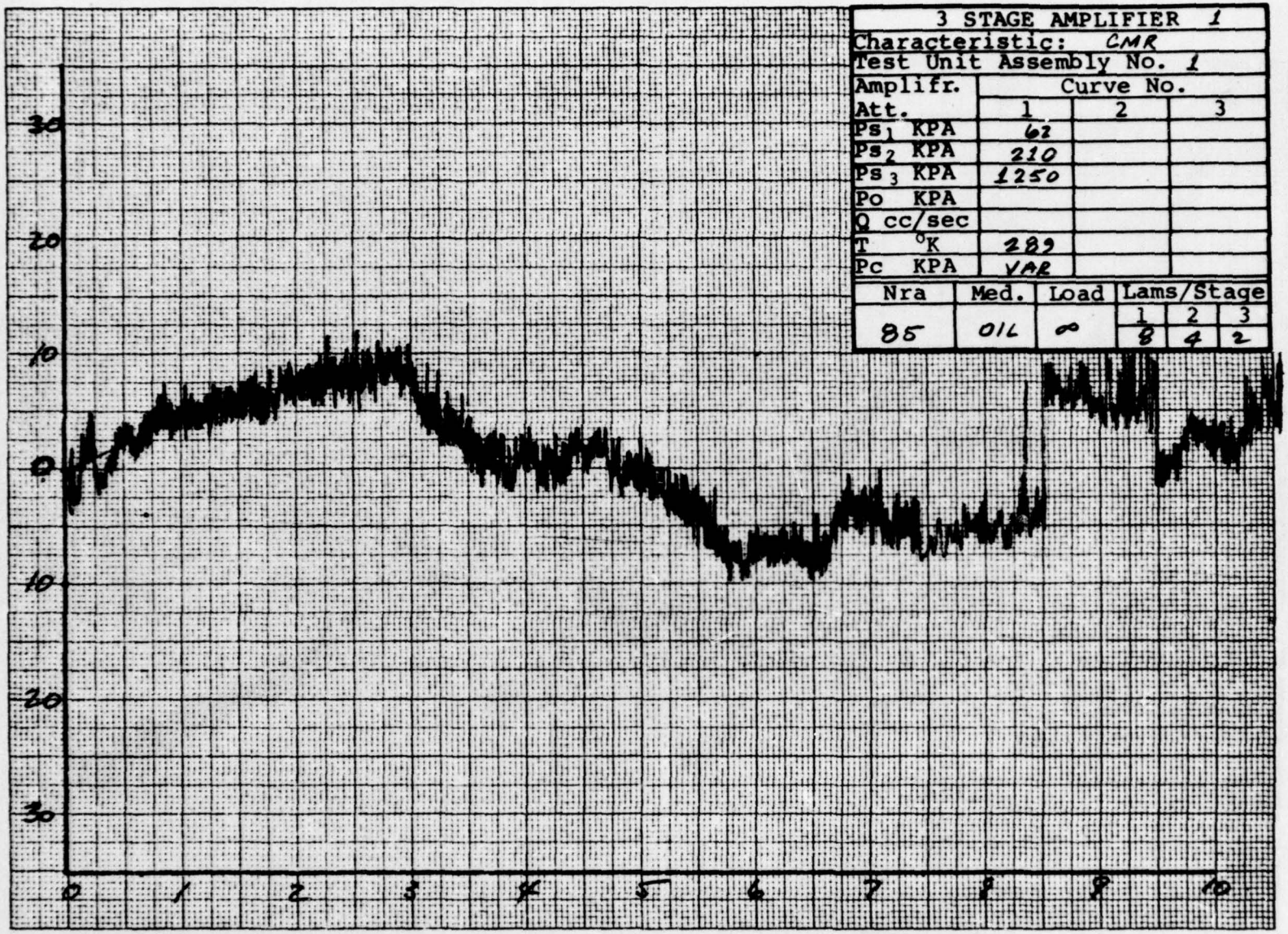

1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963



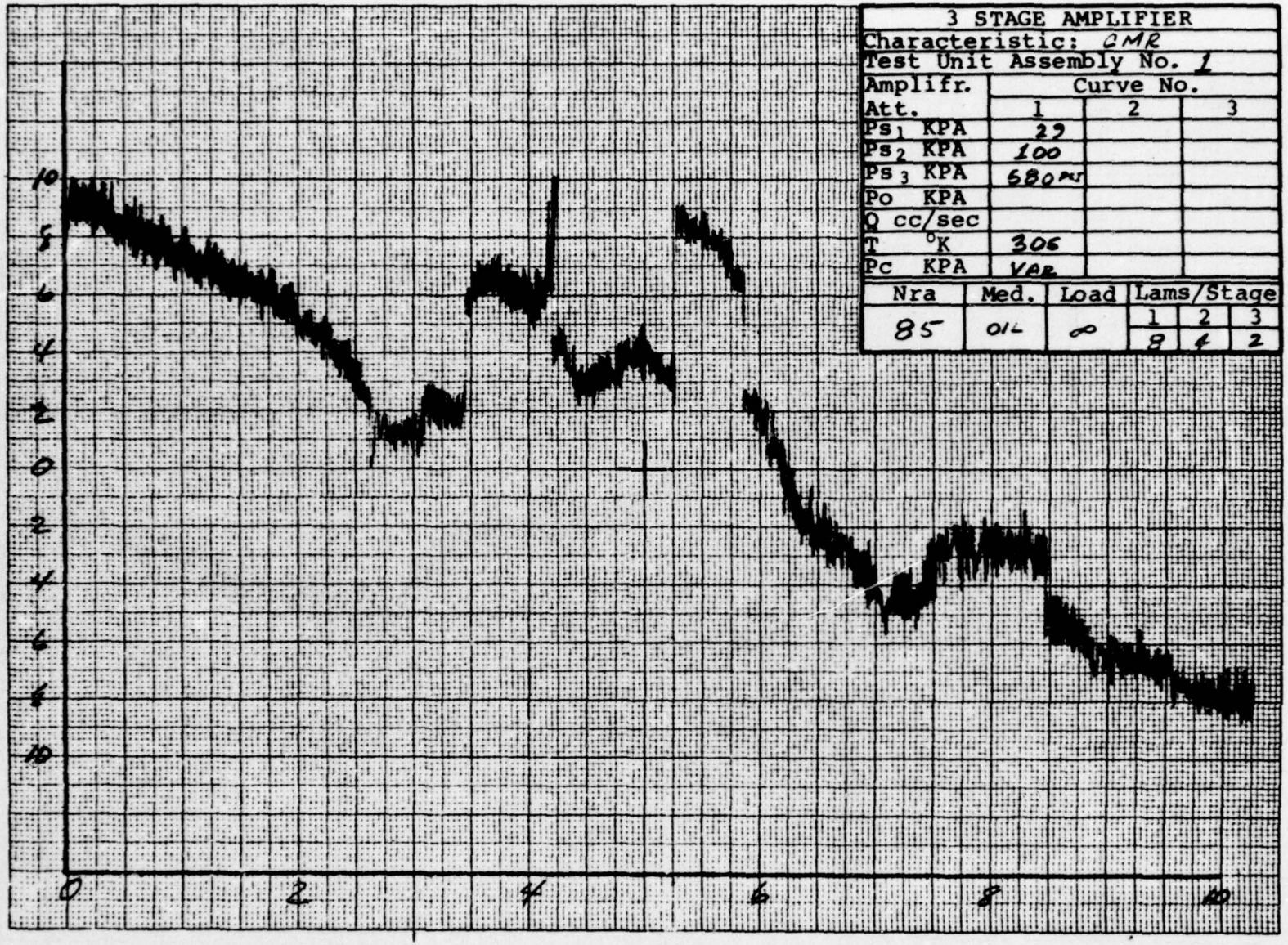

| CHARACTERISTIC | C.M.R | | |
|---|---|---|---|
| TEST UNIT P/N | 234004 | | |
| AMP. R ATTRIBUTE | CURVE NO. 1 | 2 | 3 |
| $P_s$~$K_{pa}$ | 50 PSI | | |
| $P_o$~$K_{pa}$ | | | |
| $P_c$~$K_{pa}$ | VAR | | |
| Q cc/sec | | | |
| T~°K | 330 | | |
| $N_{RA}$ | 42.5 | | |
| MEDIUM | OIL | | |
| LOAD | ∞ | | |
| NO. OF LAMINATES | 2 | | |

480

KEUFFEL & ESSER CO. NO. 358 MILLIMETERS BOTH WAYS 190 X 250 DIVISIONS
PRINTED IN U.S.A. ON KEUFFEL TECHNICAL PAPER NO. 1012


3 STAGE AMPLIFIER 1
Characteristic: CMR
Test Unit Assembly No. 1
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA 62
Ps2 KPA 210
Ps3 KPA 1250
Po KPA
Q cc/sec
T °K 289
Pc KPA VAR
Nra 85
Med. OIL
Load ∞
Lams/Stage 1 2 3
8 4 2
30
20
10
0
10
20
30
0 1 2 3 4 5 6 7 8 9 10
ΔPo, Psi
Pc, Psi

481



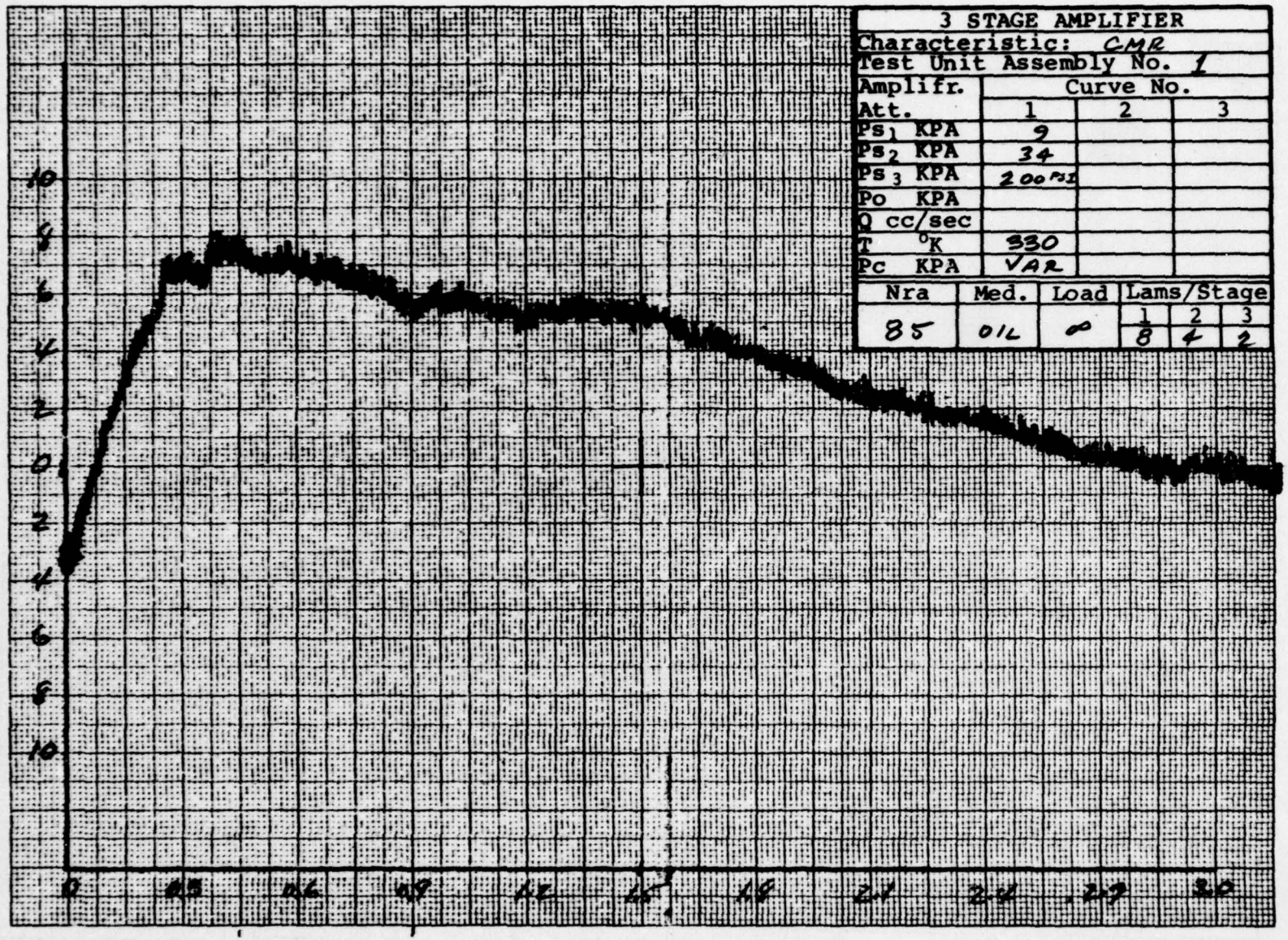

| 3 STAGE AMPLIFIER | | | | | |
|---|---|---|---|---|---|
| Characteristic: CMR | | | | | |
| Test Unit Assembly No. 1 | | | | | |
| Amplifr. Att. | Curve No. 1 | 2 | 3 | | |
| $Ps_1$ KPA | 22 | | | | |
| $Ps_2$ KPA | 100 | | | | |
| $Ps_3$ KPA | 580 PSI | | | | |
| Po KPA | | | | | |
| Q cc/sec | | | | | |
| T °K | 306 | | | | |
| Pc KPA | VAR. | | | | |

| Nra | Med. | Load | Lams/Stage 1 | 2 | 3 |
|---|---|---|---|---|---|
| 85 | OIL | ∞ | 8 | 4 | 2 |

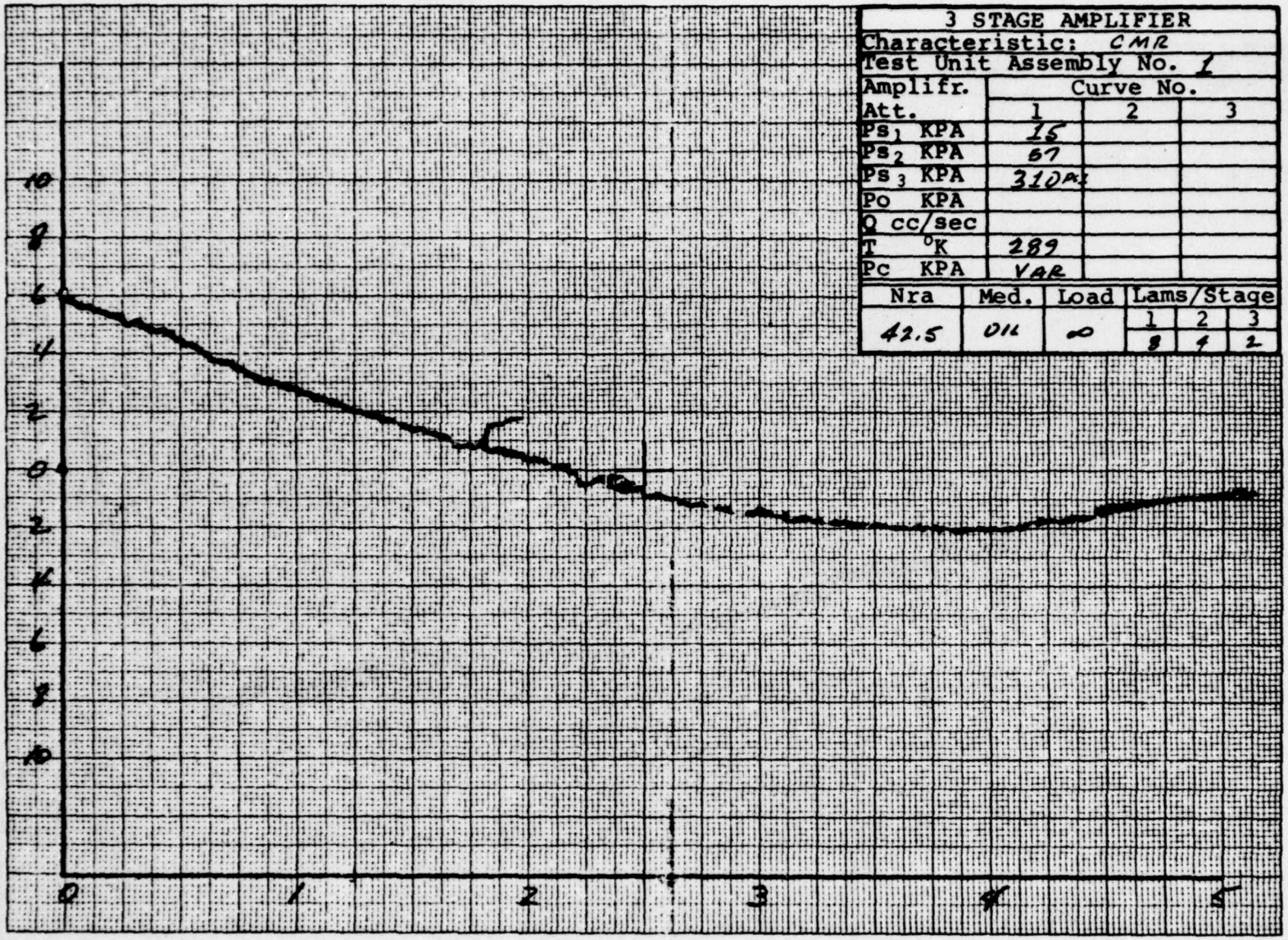
482

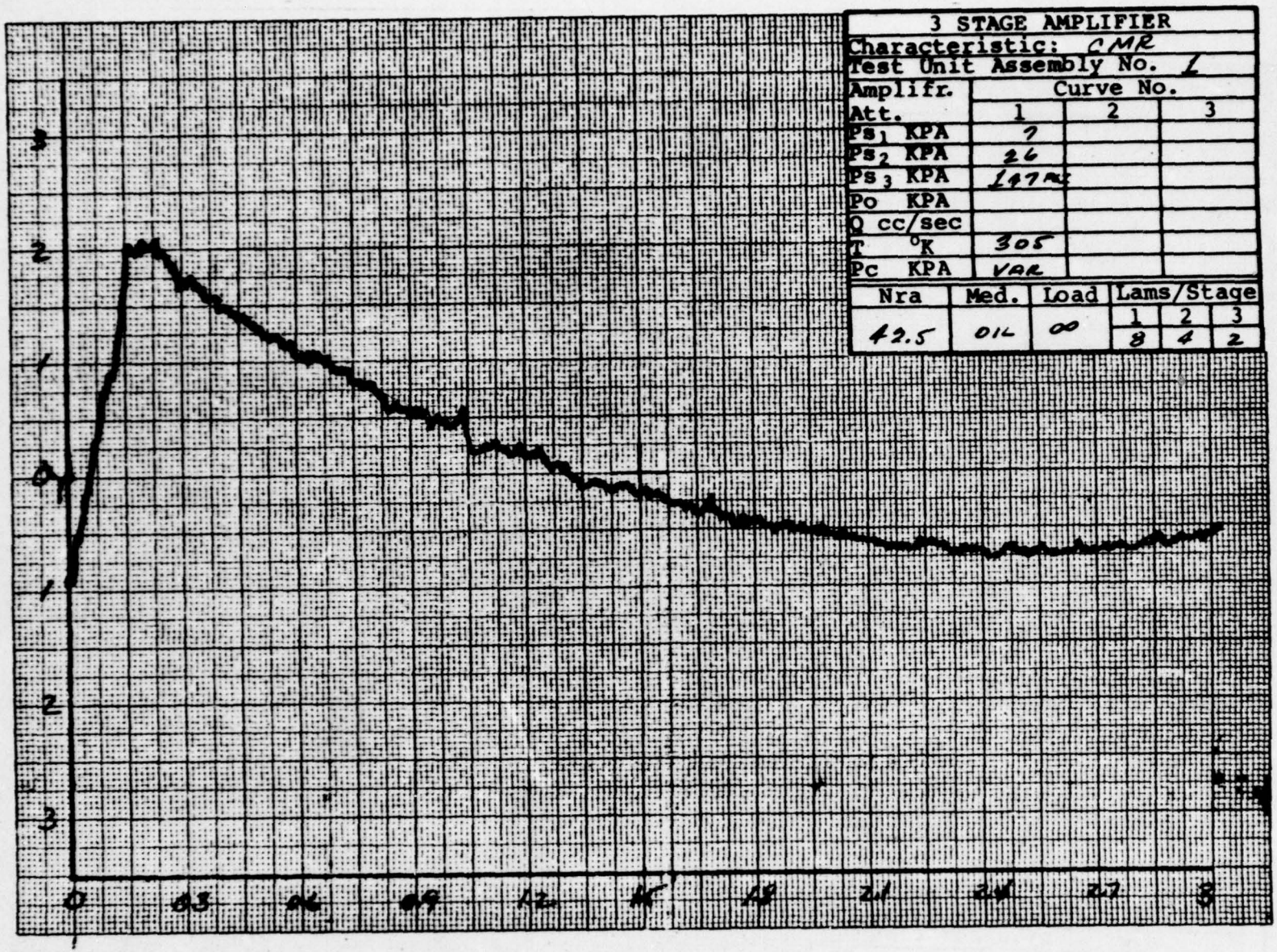
$DP_3, PS_1$

$P_c = P_1$


3 STAGE AMPLIFIER
Characteristic: CMR
Test Unit Assembly No. 1
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA 9
Ps2 KPA 34
Ps3 KPA 200 PSI
Po KPA
Q cc/sec
T °K 530
Pc KPA VAR
Nra 85
Med. OIL
Load ∞
Lams/Stage 1 2 3
1/8 1/4 1/2
10 8 6 4 2 0 2 4 6 8 10
0 0.4 0.8 1.2 1.6 2.0 2.4 2.8 3.0
ΔP, psi
Pc, psi

483


3 STAGE AMPLIFIER
Characteristic: CMR
Test Unit Assembly No. 1
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA 15
Ps2 KPA 57
Ps3 KPA 310
Po KPA
Q cc/sec
T °K 289
Pc KPA VAR
Nra 42.5
Med. OIL
Load ∞
Lams/Stage 1 2 3
3 4 2
10
8
6
4
2
0
2
4
6
8
10
0
1
2
3
4
5
ΔPs, psi
Pc, psi


3 STAGE AMPLIFIER
Characteristic: CMR
Test Unit Assembly No. 1
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA 7
Ps2 KPA 26
Ps3 KPA 147 PSI
Po KPA
Q cc/sec
T °K 305
Pc KPA VAR
Nra 42.5
Med. OIL
Load ∞
Lams/Stage 1 2 3
8 4 2
ΔPo, psi
Pc, psi
0 .03 .06 .09 .12 .15 .18 .21 .24 .27 .3
3 2 1 0 1 2 3

485

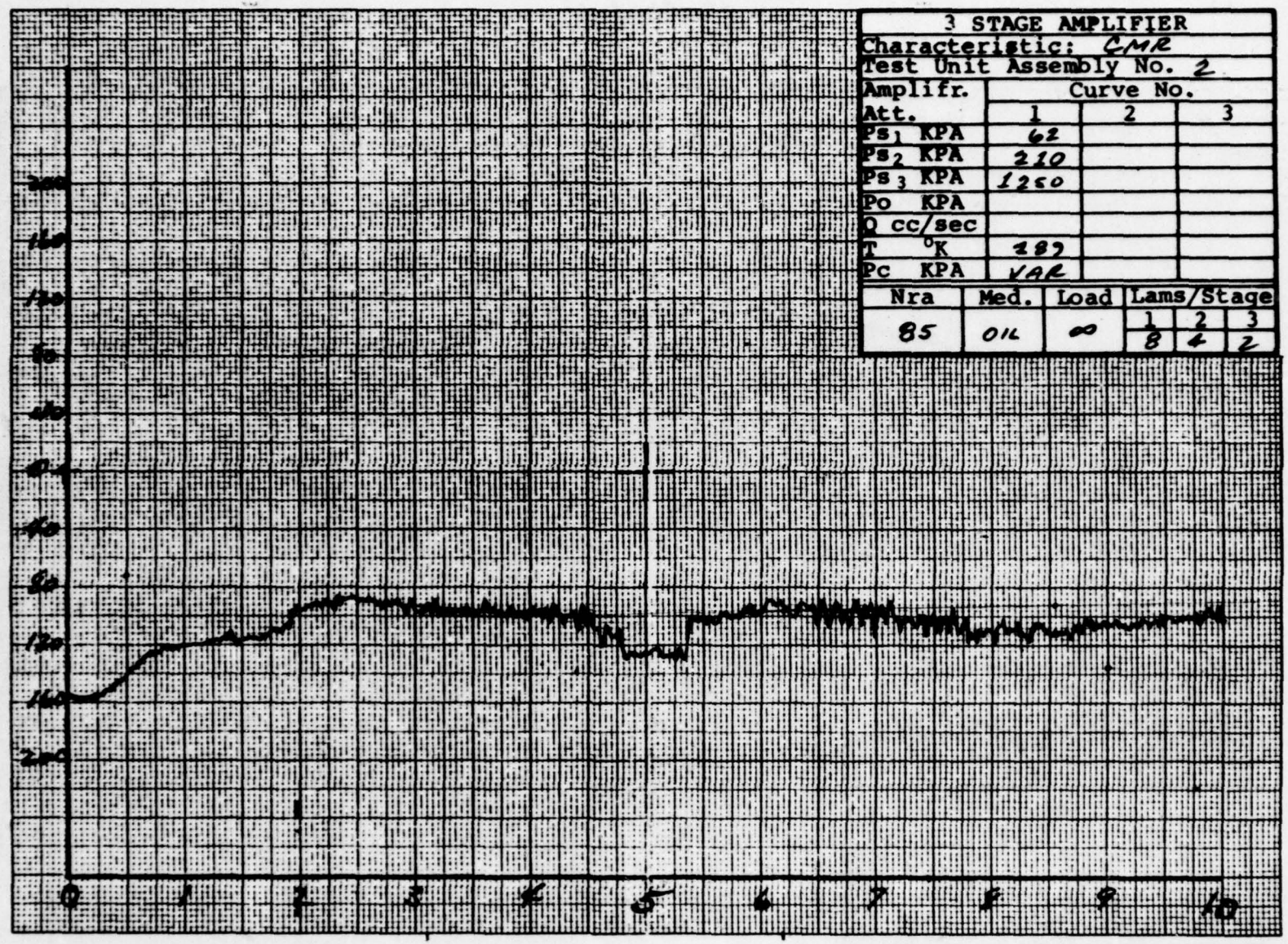


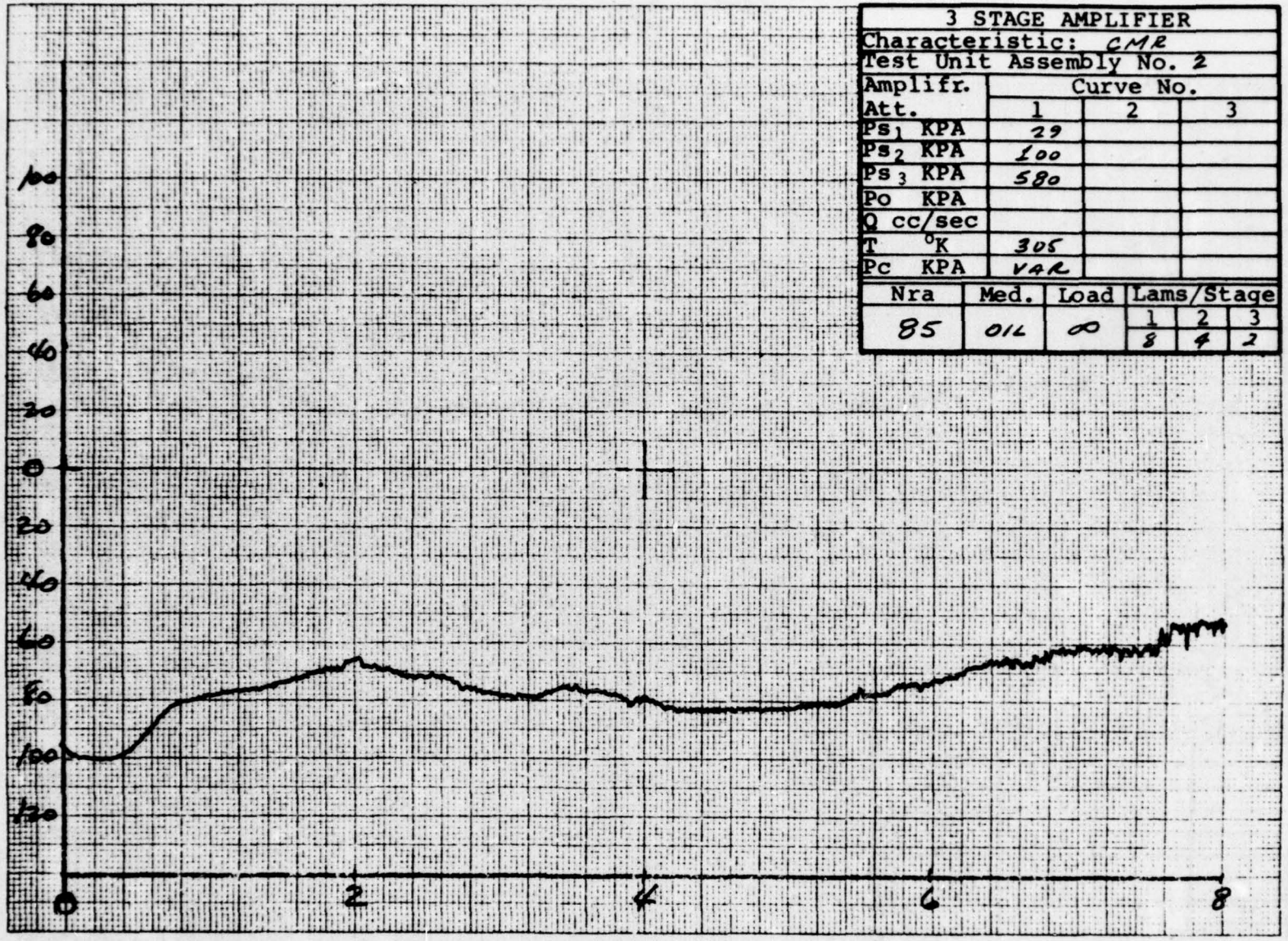

| 3 STAGE AMPLIFIER | | | | |
|---|---|---|---|---|
| Characteristic: CMR | | | | |
| Test Unit Assembly No. 1 | | | | |
| Amplifr. Att. | Curve No. 1 | 2 | 3 | |
| $Ps_1$ KPA | 2.3 | | | |
| $Ps_2$ KPA | 8 | | | |
| $Ps_3$ KPA | 50 PSI | | | |
| Po KPA | | | | |
| Q cc/sec | | | | |
| T °K | 330 | | | |
| Pc KPA | VAR | | | |

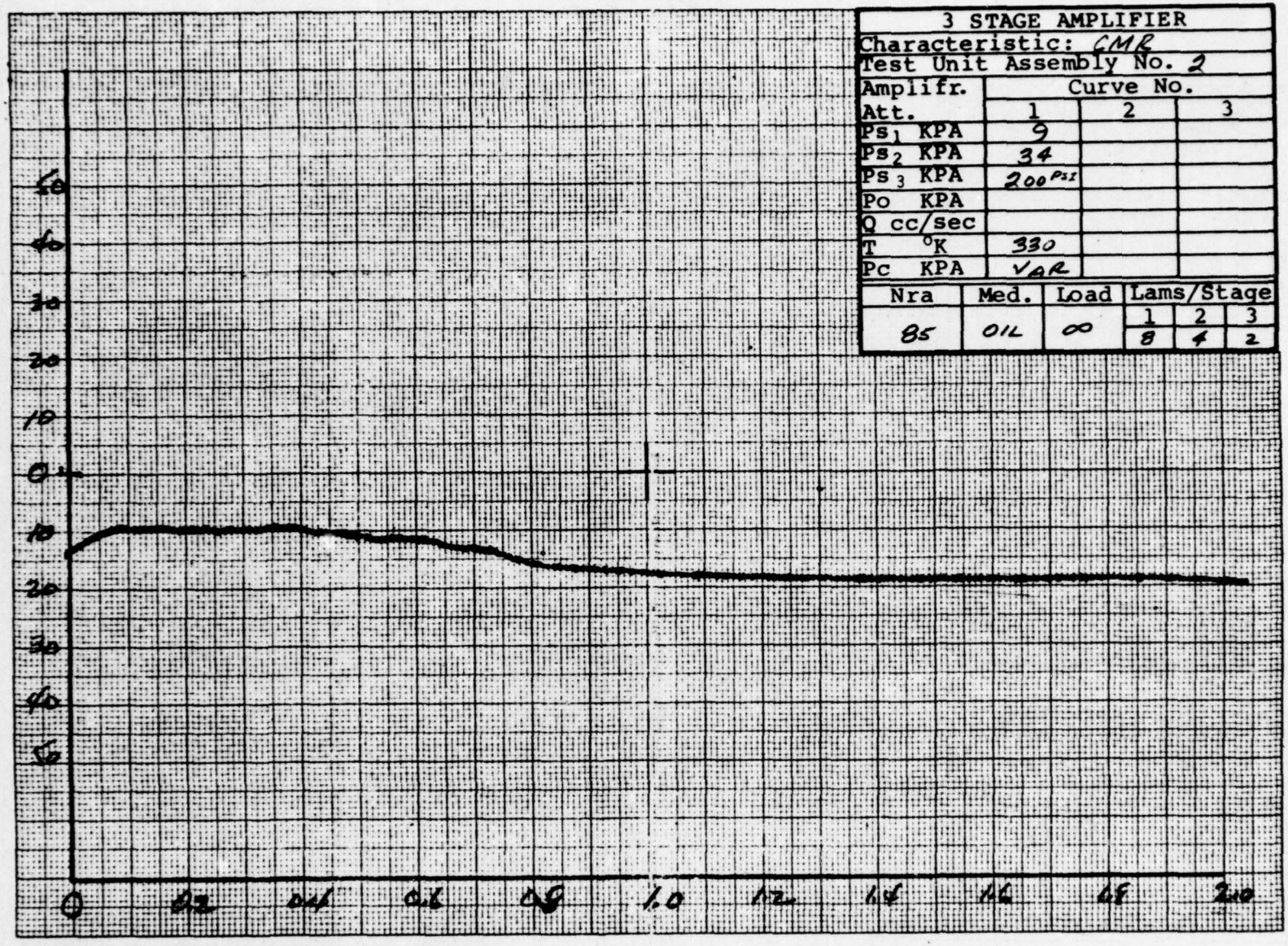
| Nra | Med. | Load | Lams/Stage 1 | 2 | 3 |
|---|---|---|---|---|---|
| 42.5 | Oil | ∞ | 8 | 4 | 2 |

$\Delta P_o$, psi

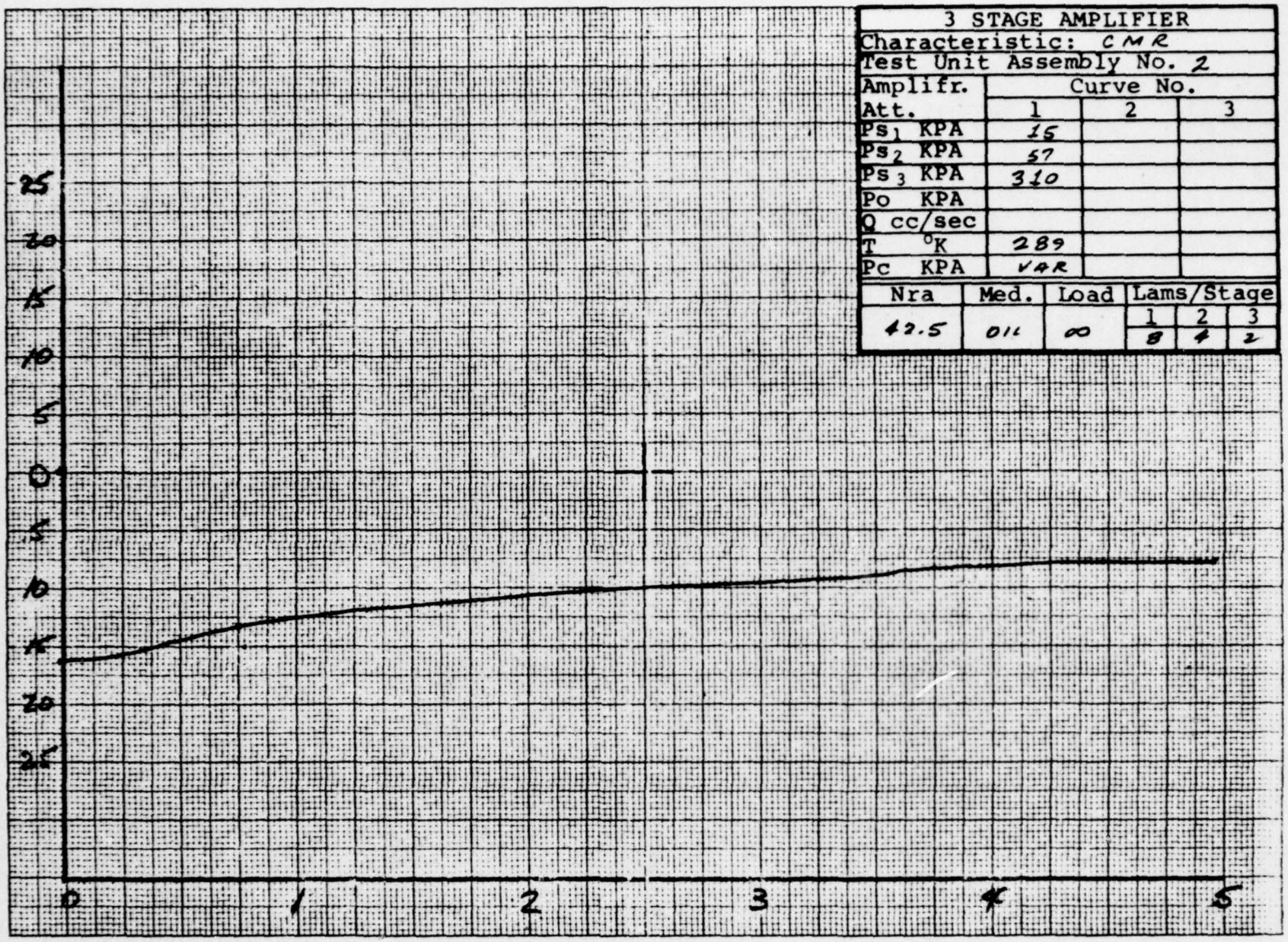
$P_c$, psi


3 STAGE AMPLIFIER
Characteristic: CMR
Test Unit Assembly No. 2
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA 62
Ps2 KPA 210
Ps3 KPA 1250
Po KPA
Q cc/sec
T °K 287
Pc KPA VAR
Nra 85
Med. OIL
Load ∞
Lams/Stage 1 2 3
1/8 1/4 1/2
ΔPo, PSI
Pc, PSI
0 1 2 3 4 5 6 7 8 9 10


3 STAGE AMPLIFIER
Characteristic: CMR
Test Unit Assembly No. 2
Amplifr. Att.
Curve No.
1 2 3
Ps1 KPA 29
Ps2 KPA 100
Ps3 KPA 580
Po KPA
Q cc/sec
T °K 305
Pc KPA VAR
Nra 85
Med. OIL
Load ∞
Lams/Stage 1 2 3
8 4 2
100 80 60 40 20 0 20 40 60 80 100 120
0 2 4 6 8
ΔPs, psi
Pc, psi


3 STAGE AMPLIFIER
Characteristic: CMR
Test Unit Assembly No. 2
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA 9
Ps2 KPA 34
Ps3 KPA 200 PSI
Po KPA
Q cc/sec
T °K 330
Pc KPA VAR
Nra 85
Med. OIL
Load ∞
Lams/Stage 1 2 3
8 4 2
50
40
30
20
10
0
10
20
30
40
50
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
ΔPo, PSI
Pc, PSI

489

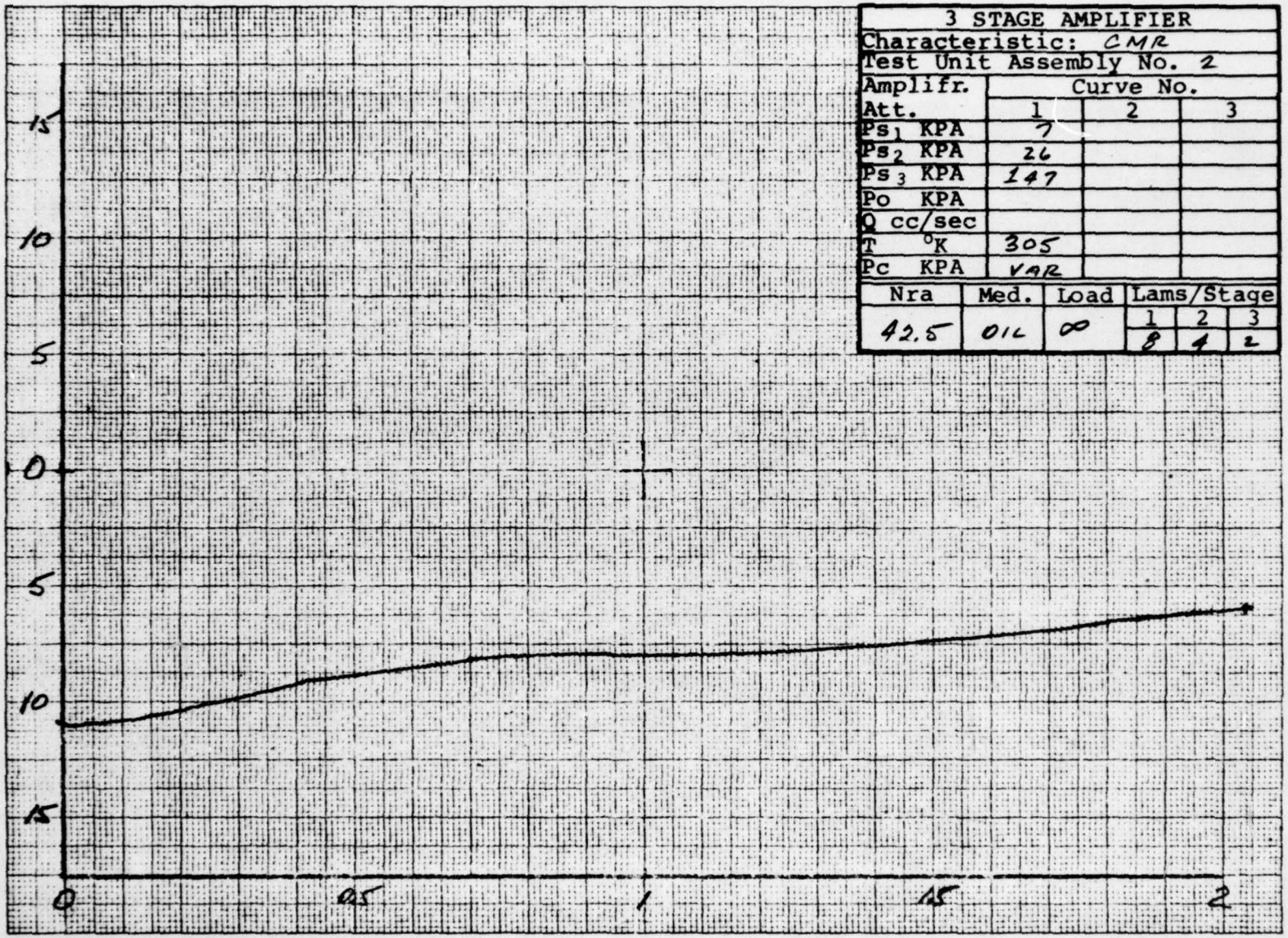



| 3 STAGE AMPLIFIER | | | | |
|---|---|---|---|---|
| Characteristic: CMR | | | | |
| Test Unit Assembly No. 2 | | | | |
| Amplifr. Att. | Curve No. 1 | 2 | 3 | |
| $Ps_1$ KPA | 15 | | | |
| $Ps_2$ KPA | 57 | | | |
| $Ps_3$ KPA | 310 | | | |
| Po KPA | | | | |
| Q cc/sec | | | | |
| T °K | 289 | | | |
| Pc KPA | VAR | | | |

| Nra | Med. | Load | Lams/Stage 1 | 2 | 3 |
|---|---|---|---|---|---|
| 42.5 | 011 | ∞ | 8 | 4 | 2 |

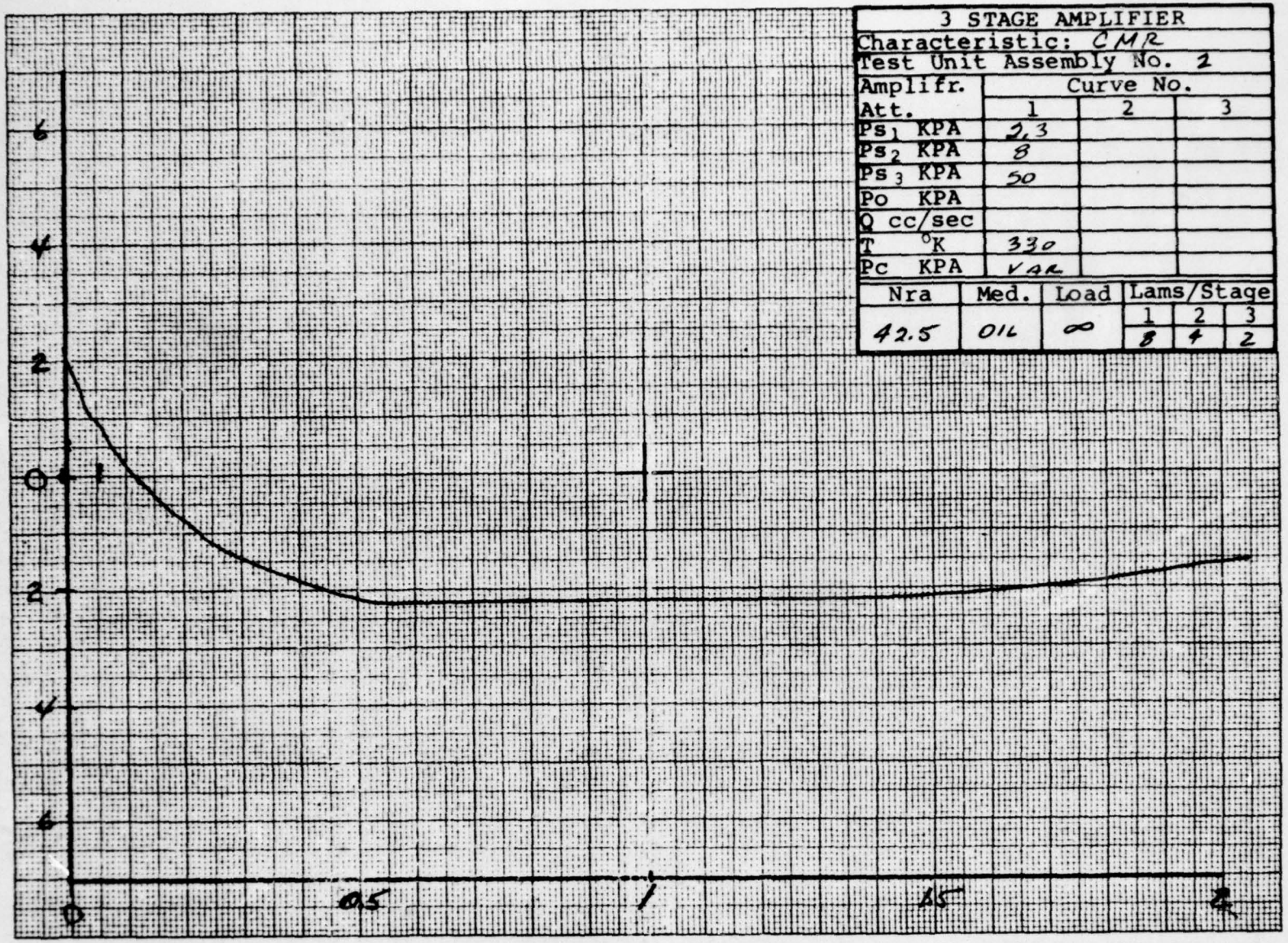


GRAPHIC CHARTS
GRAPHIKA PAPER CO. NO. C38 MILLIMETERS BOTH WAYS 180 X 250 DIVISIONS PRINTED IN U.S.A. ON GRAPHIKA TECHNICAL PAPER NO. 1018




| 3 STAGE AMPLIFIER | | | | | |
|---|---|---|---|---|---|
| Characteristic: CMR | | | | | |
| Test Unit Assembly No. 2 | | | | | |
| Amplifr. Att. | Curve No. 1 | 2 | 3 | | |
| $Ps_1$ KPA | 7 | | | | |
| $Ps_2$ KPA | 26 | | | | |
| $Ps_3$ KPA | 147 | | | | |
| Po KPA | | | | | |
| Q cc/sec | | | | | |
| T °K | 305 | | | | |
| Pc KPA | VAR | | | | |

| Nra | Med. | Load | Lams/Stage 1 | 2 | 3 |
|---|---|---|---|---|---|
| 42.5 | OIL | ∞ | 8 | 4 | 2 |

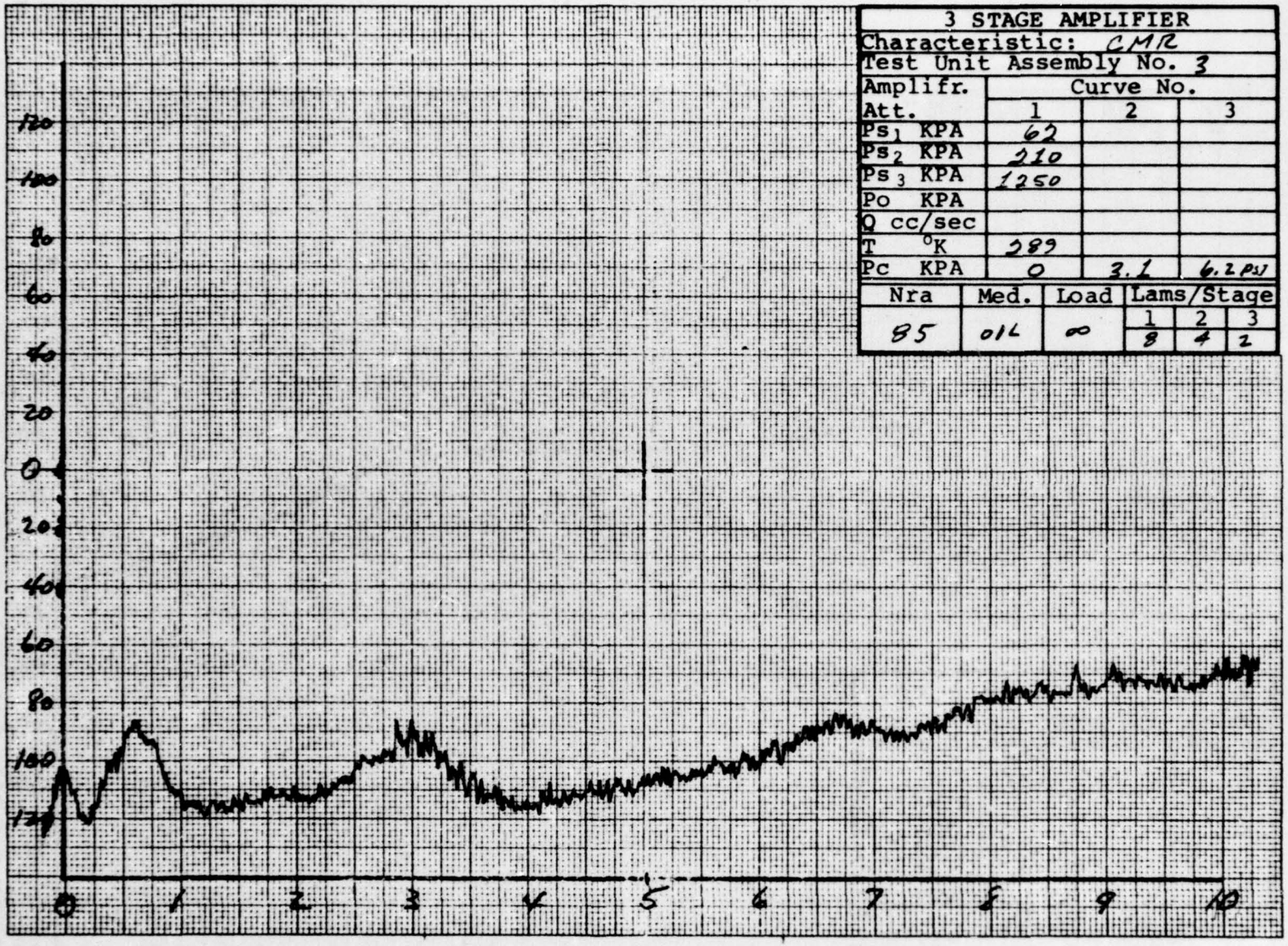


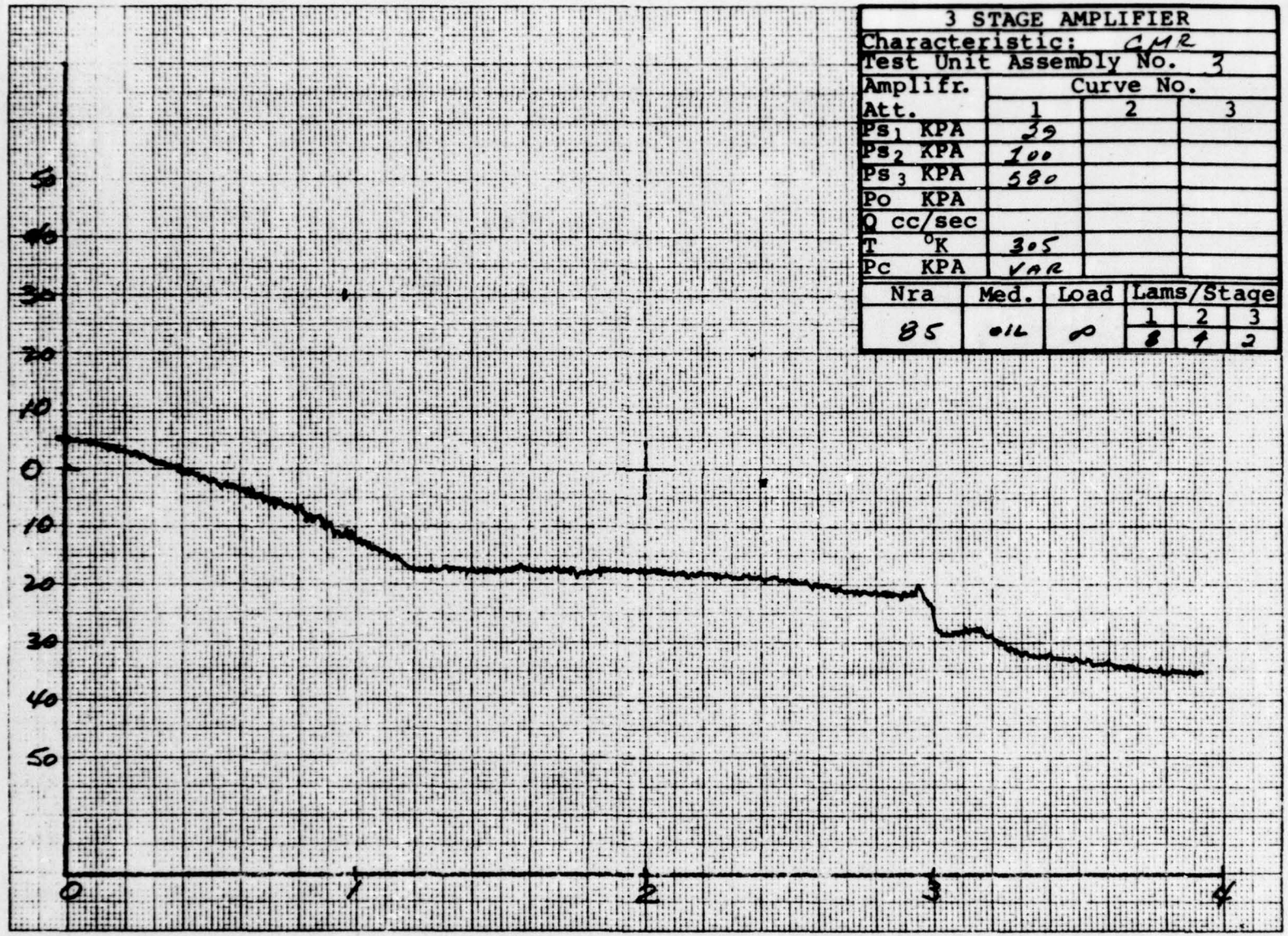

| 3 STAGE AMPLIFIER | | | |
|---|---|---|---|
| Characteristic: CMR | | | |
| Test Unit Assembly No. 2 | | | |
| Amplifr. Att. | Curve No. 1 | 2 | 3 |
| $Ps_1$ KPA | 2.3 | | |
| $Ps_2$ KPA | 8 | | |
| $Ps_3$ KPA | 50 | | |
| Po KPA | | | |
| Q cc/sec | | | |
| T °K | 330 | | |
| Pc KPA | VAR | | |

| Nra | Med. | Load | Lams/Stage 1 | 2 | 3 |
|---|---|---|---|---|---|
| 42.5 | OIL | ∞ | 8 | 4 | 2 |



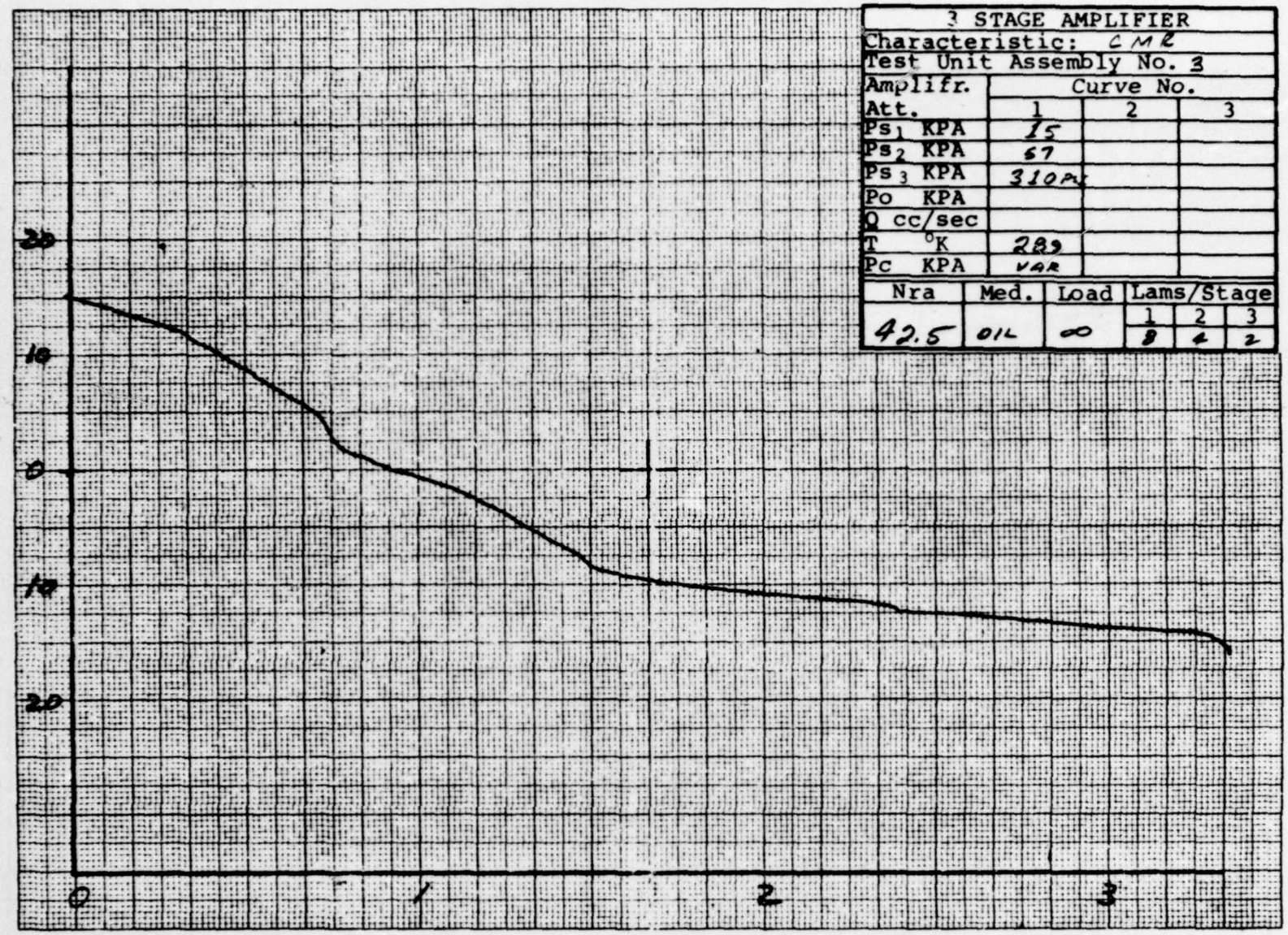
CLEARPRINT PAPER CO. NO. C35 MILLIMETERS BOTH WAYS 100 X 350 DIVISIONS
PRINTED IN U.S.A. ON CLEARPRINT TECHNICAL PAPER NO. 1010


3 STAGE AMPLIFIER
Characteristic: CMR
Test Unit Assembly No. 3
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA 62
Ps2 KPA 210
Ps3 KPA 1250
Po KPA
Q cc/sec
T °K 289
Pc KPA 0 3.1 6.2 psi
Nra 85
Med. oil
Load ∞
Lams/Stage 1 2 3
8 4 2
120
100
80
60
40
20
0
20
40
60
80
100
120
0 1 2 3 4 5 6 7 8 9 10
ΔPo, psi
Pc, psi


3 STAGE AMPLIFIER
Characteristic: CMR
Test Unit Assembly No. 3
Amplifr. Att.
Curve No. 1 2 3
Ps1 KPA 39
Ps2 KPA 100
Ps3 KPA 580
Po KPA
Q cc/sec
T °K 305
Pc KPA VAR
Nra 85
Med. oil
Load ∞
Lams/Stage 1 2 3
8 4 2
ΔPo, psi
Pc, psi
0 1 2 3 4
50 40 30 20 10 0 10 20 30 40 50

494

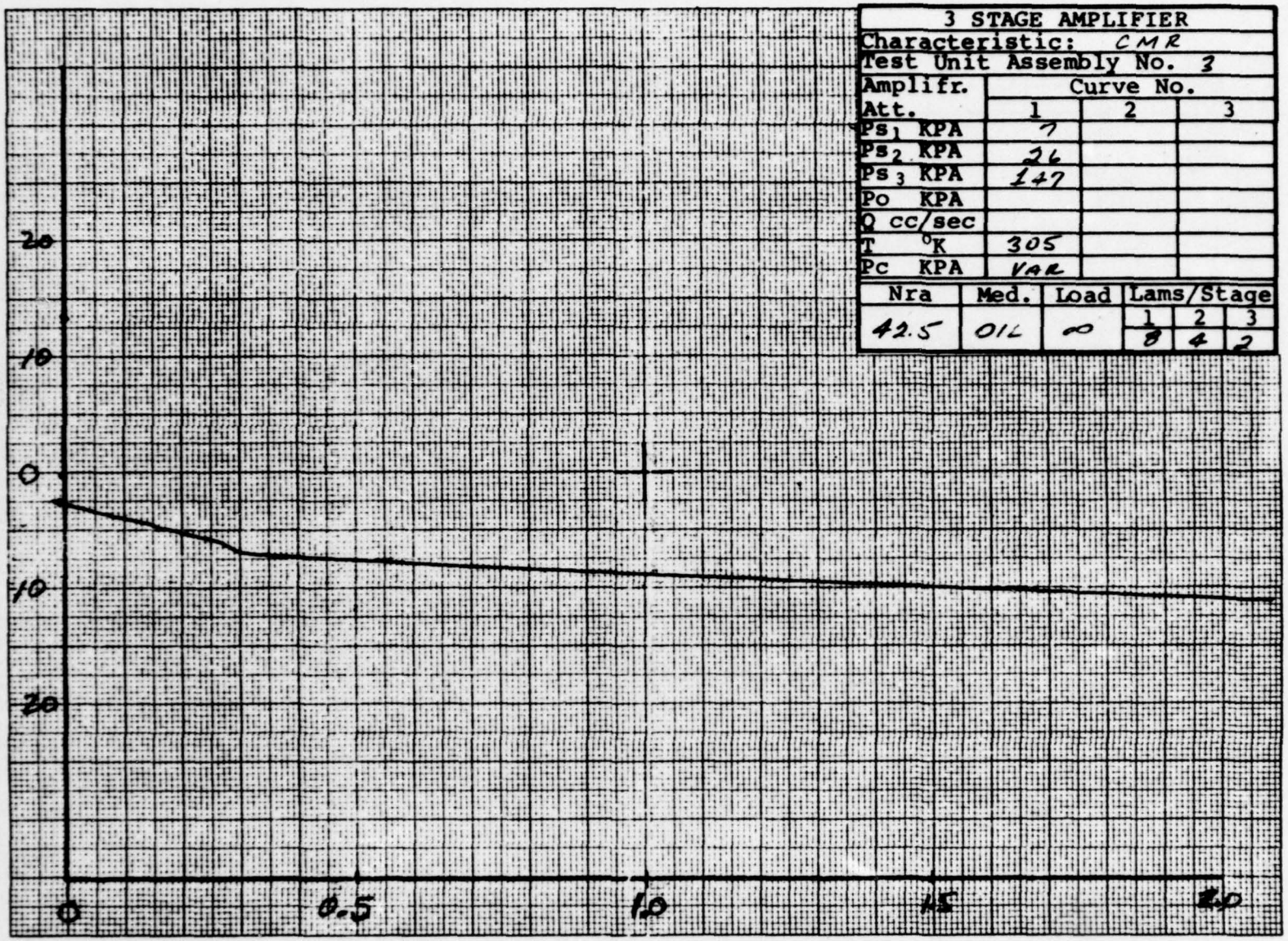

3 STAGE AMPLIFIER
Characteristic: CMR
Test Unit Assembly No. 3
Amplifr. Curve No. 1 2 3
Att.
Ps1 KPA 9
Ps2 KPA 34
Ps3 KPA 200
Po KPA
Q cc/sec
T °K 320
Pc KPA VAR
Nra 85
Med. OIL
Load ∞
Lams/Stage 1 2 3
8 4 2
20
16
12
8
4
0
4
8
12
16
20
0
0.4
0.8
1.2
1.6
ΔP0,1 psi
Pc, psi

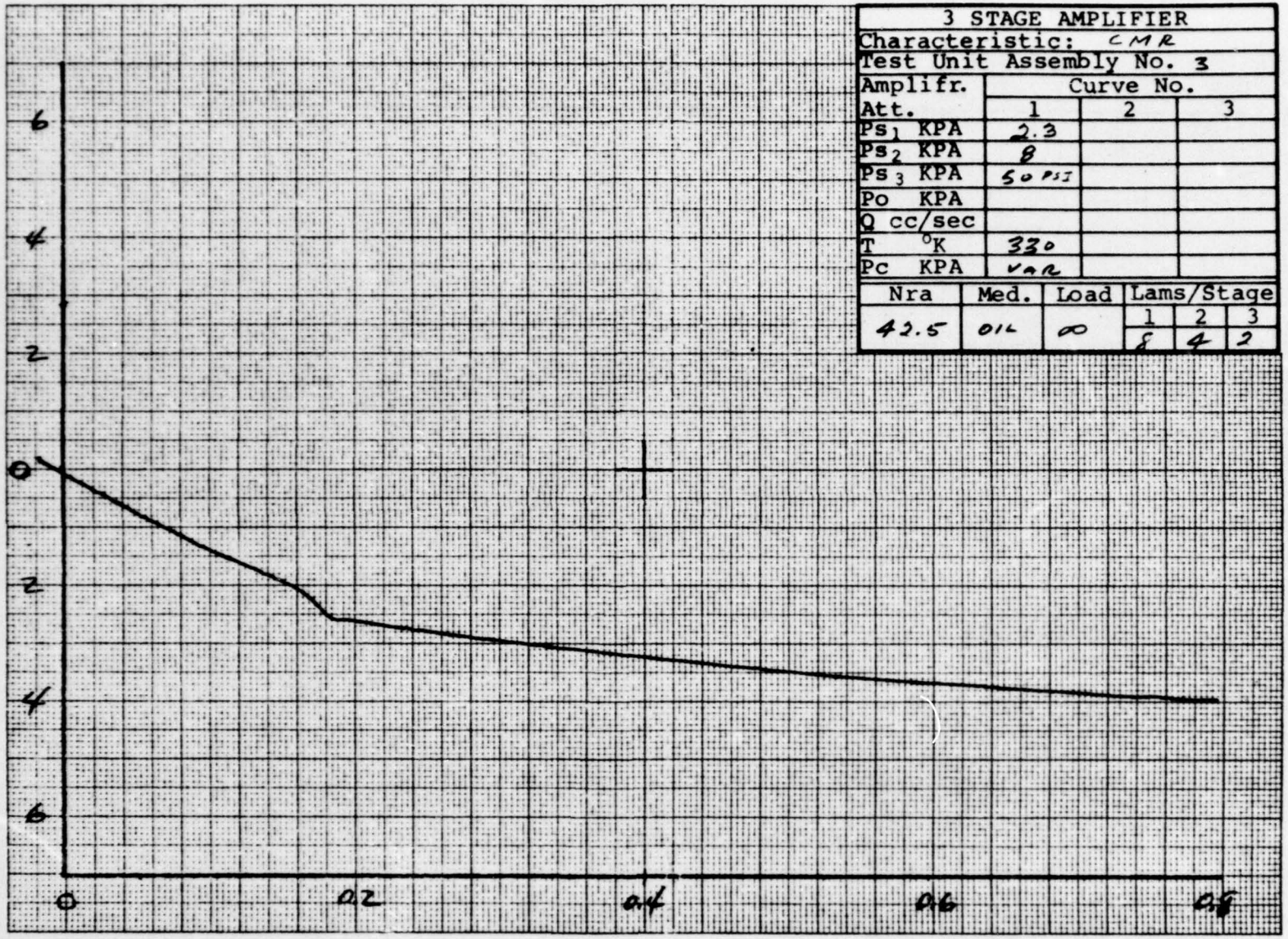



| 3 STAGE AMPLIFIER | | | |
|---|---|---|---|
| Characteristic: CMR | | | |
| Test Unit Assembly No. 3 | | | |
| Amplifr. Att. | Curve No. 1 | 2 | 3 |
| $Ps_1$ KPA | 15 | | |
| $Ps_2$ KPA | 57 | | |
| $Ps_3$ KPA | 310 Pc | | |
| Po KPA | | | |
| Q cc/sec | | | |
| T °K | 289 | | |
| Pc KPA | VAR | | |

| Nra | Med. | Load | Lams/Stage 1 | 2 | 3 |
|---|---|---|---|---|---|
| 42.5 | OIL | ∞ | 8 | 4 | 2 |

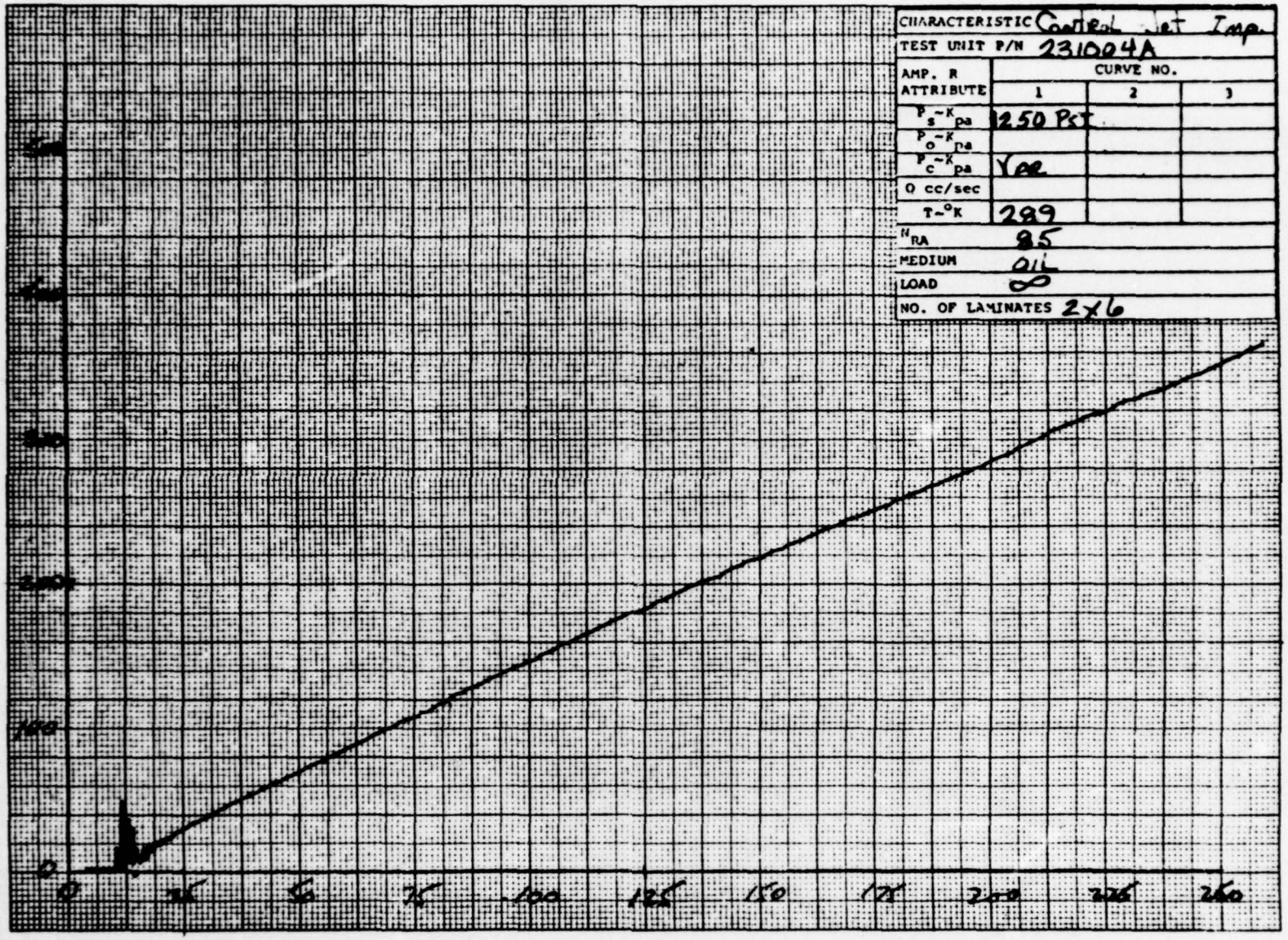
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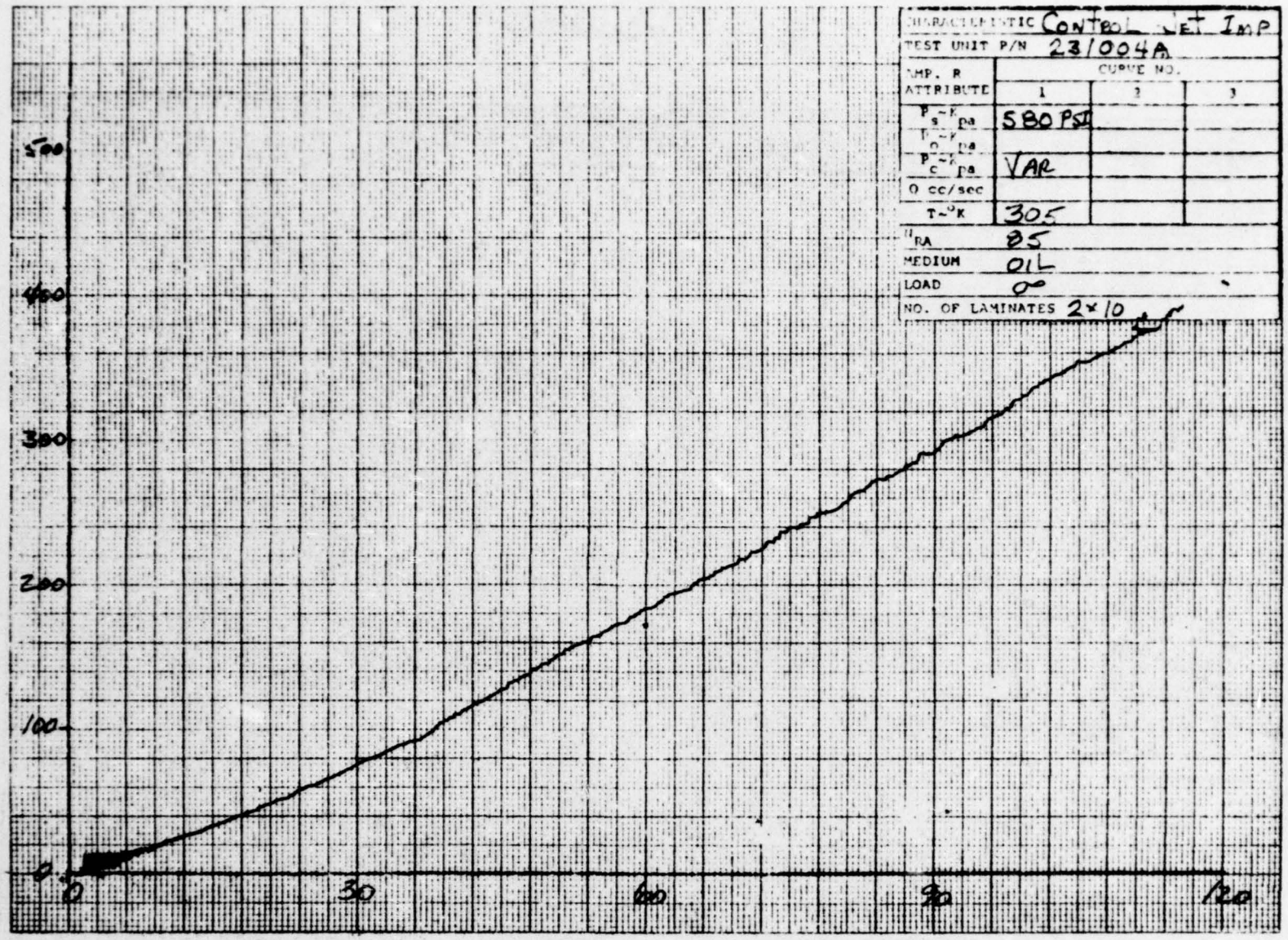

3 STAGE AMPLIFIER
Characteristic: CMR
Test Unit Assembly No. 3
Amplifr. Att.
Curve No.
1 2 3
Ps1 KPA 7
Ps2 KPA 26
Ps3 KPA 147
Po KPA
Q cc/sec
T °K 305
Pc KPA VAR
Nra 42.5
Med. OIL
Load ∞
Lams/Stage
1 2 3
8 4 2
20
10
0
10
20
0
0.5
1.0
1.5
2.0
ΔP0, psi
Pc, psi

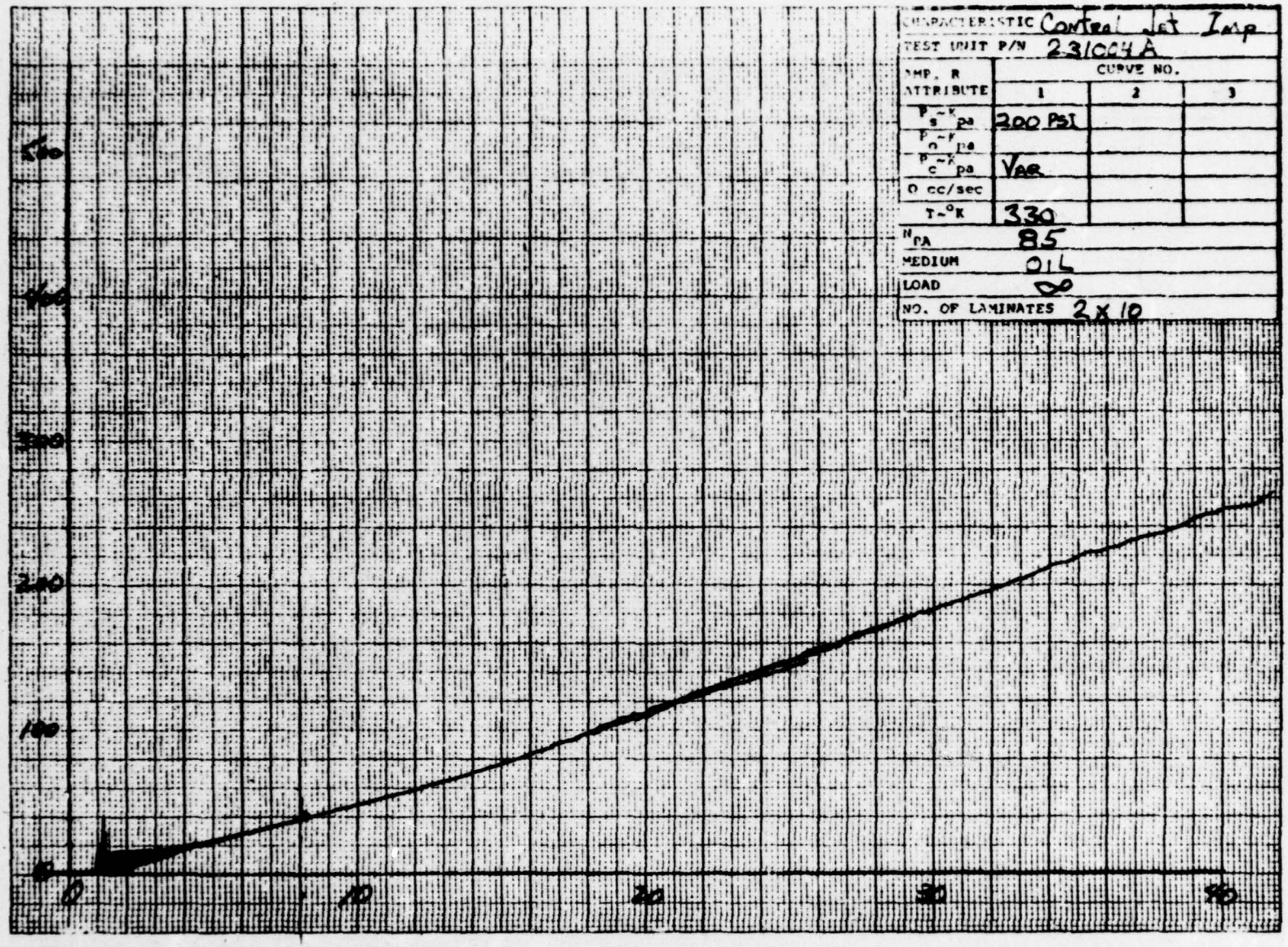


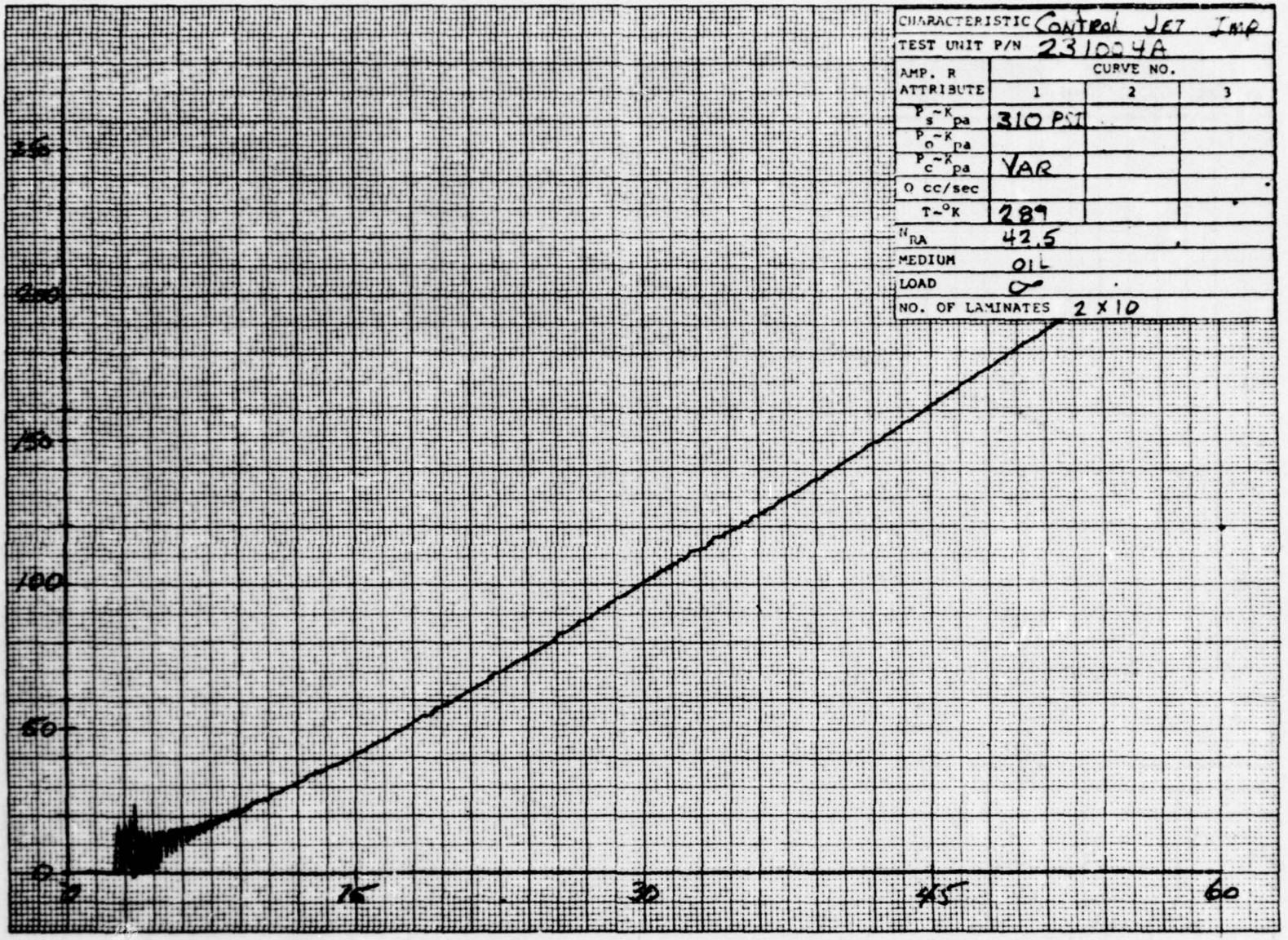

| 3 STAGE AMPLIFIER | | | | | |
|---|---|---|---|---|---|
| Characteristic: CMR | | | | | |
| Test Unit Assembly No. 3 | | | | | |
| Amplifr. Att. | Curve No. | | | | |
| | 1 | 2 | 3 | | |
| $Ps_1$ KPA | 2.3 | | | | |
| $Ps_2$ KPA | 8 | | | | |
| $Ps_3$ KPA | 50 PSI | | | | |
| Po KPA | | | | | |
| Q cc/sec | | | | | |
| T °K | 330 | | | | |
| Pc KPA | var | | | | |

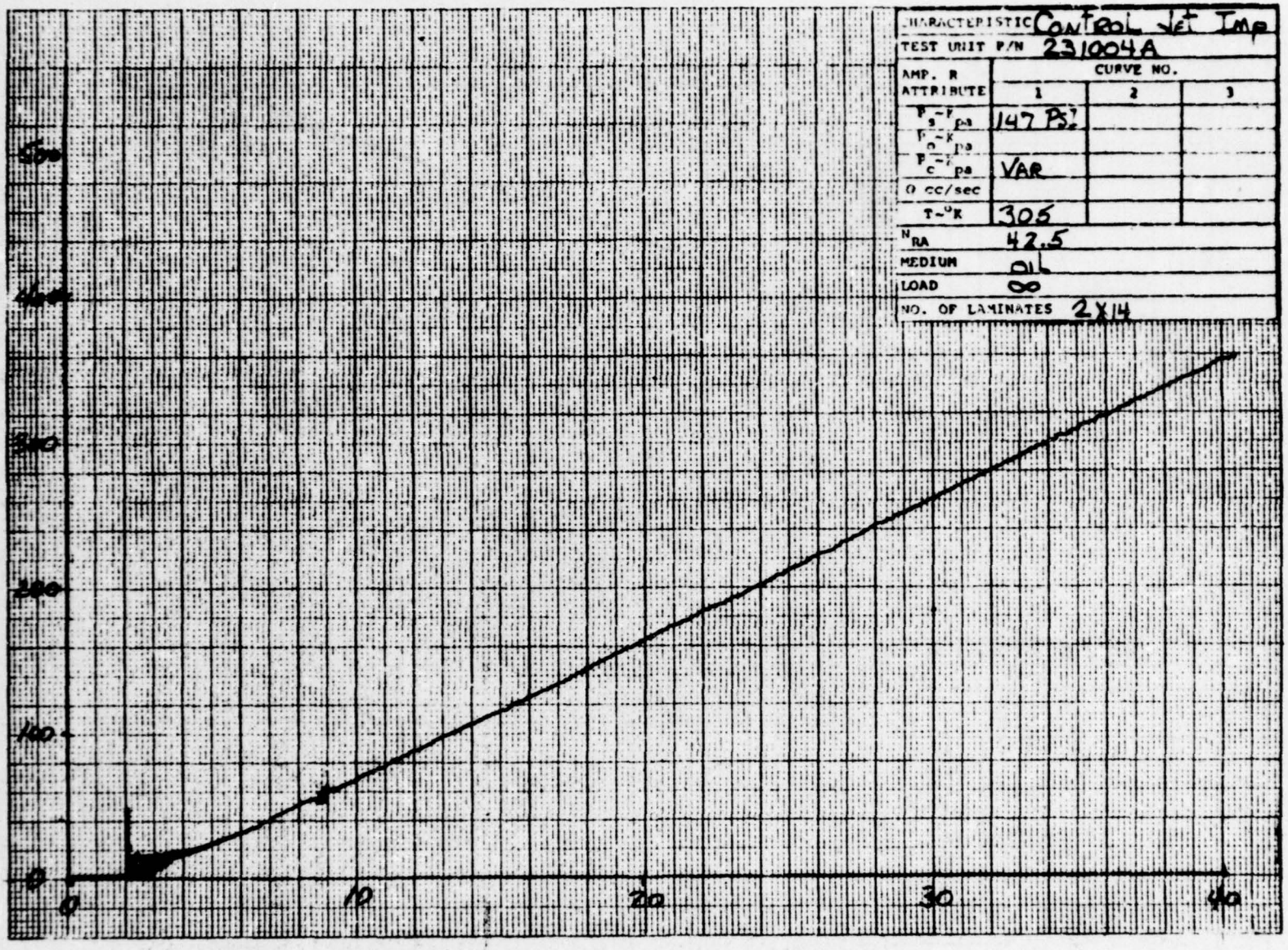
| Nra | Med. | Load | Lams/Stage | | |
|---|---|---|---|---|---|
| | | | 1 | 2 | 3 |
| 42.5 | oil | ∞ | 8 | 4 | 2 |

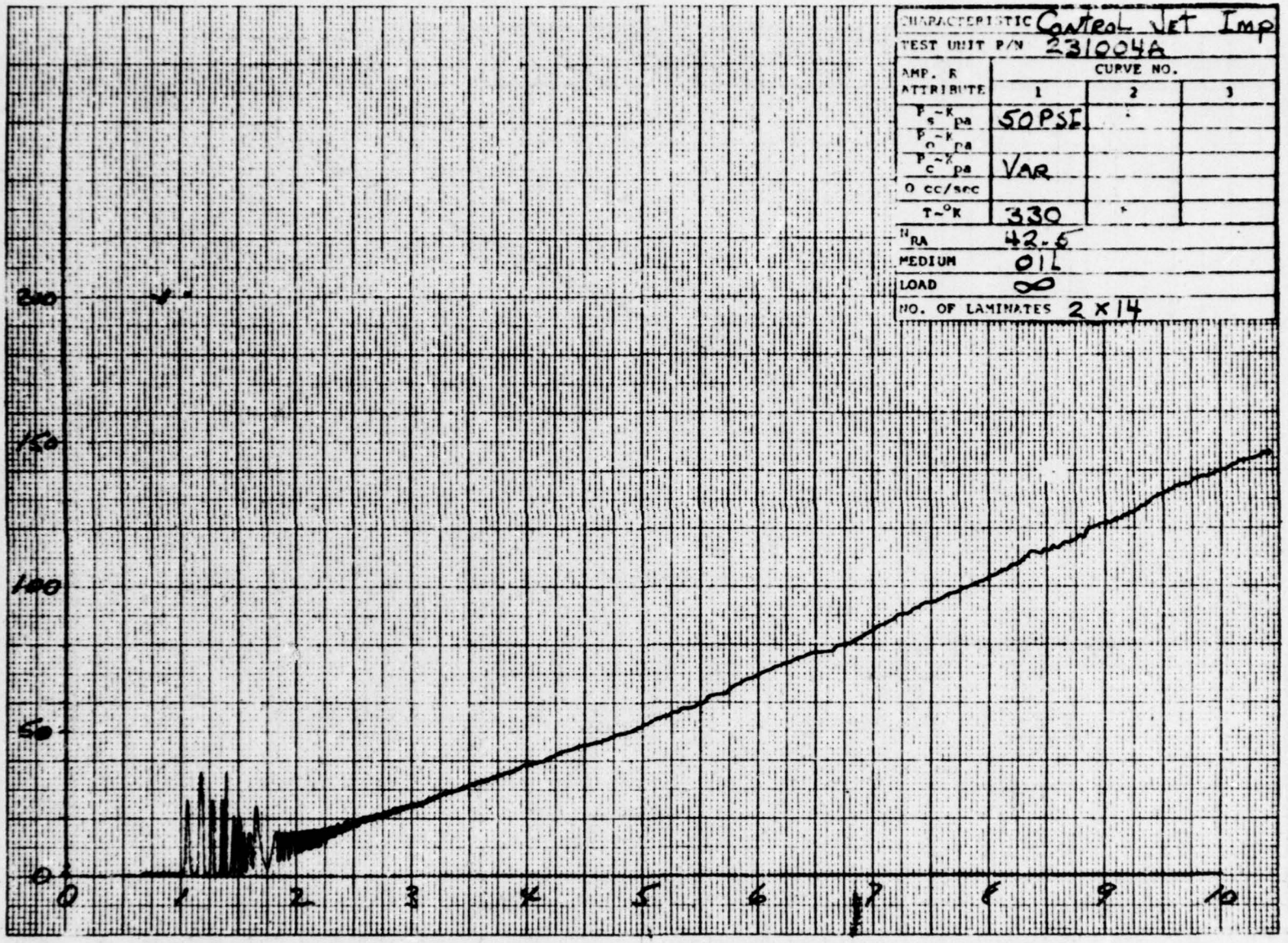

CHARACTERISTIC Control Jet Imp.
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$-Kpa 1250 PSI
$P_o$-Kpa
$P_c$-Kpa Vac
Q cc/sec
T-°K 289
$N_{RA}$ 85
MEDIUM Oil
LOAD ∞
NO. OF LAMINATES 2x6
CONTROL FLOW, Hz
CONTROL PRESS, PSI
0
25
50
75
100
125
150
175
200
225
250


CHARACTERISTIC CONTROL JET IMP
TEST UNIT P/N 23004A
IMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~ PSIA
580 PSI
$T_0$ ~ °K
$P_c$ ~ PSIA
VAR
Q cc/sec
T ~ °K
305
$\eta_{RA}$
85
MEDIUM
OIL
LOAD
∞
NO. OF LAMINATES
2×10
500
400
300
200
100
0
0
30
60
90
120
Control Flow, Hz
CONTROL PRESS, PSI


CHARACTERISTIC Control Jet Imp
TEST UNIT P/N 2310674A
IMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$-psi 200 PSI
$P_o$-psi
$P_c$-psi Var
0 cc/sec
T-°K 330
N PA 85
MEDIUM OIL
LOAD ∞
NO. OF LAMINATES 2 x 10
0
10
20
30
40
CONTROL PRESS, PSI
CONTROL FLOW, HZ
SOL


CHARACTERISTIC Control Jet Imp
TEST UNIT P/N 2310-24A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa 310 PSI
$P_o$~Kpa
$P_c$~Kpa VAR
0 cc/sec
T~°K 289
$N_{RA}$ 42.5
MEDIUM OIL
LOAD 0
NO. OF LAMINATES 2 X 10
250
200
150
100
50
0
15
30
45
60
CONTROL FLOW, HZ
CONTROL PRESS, PSI

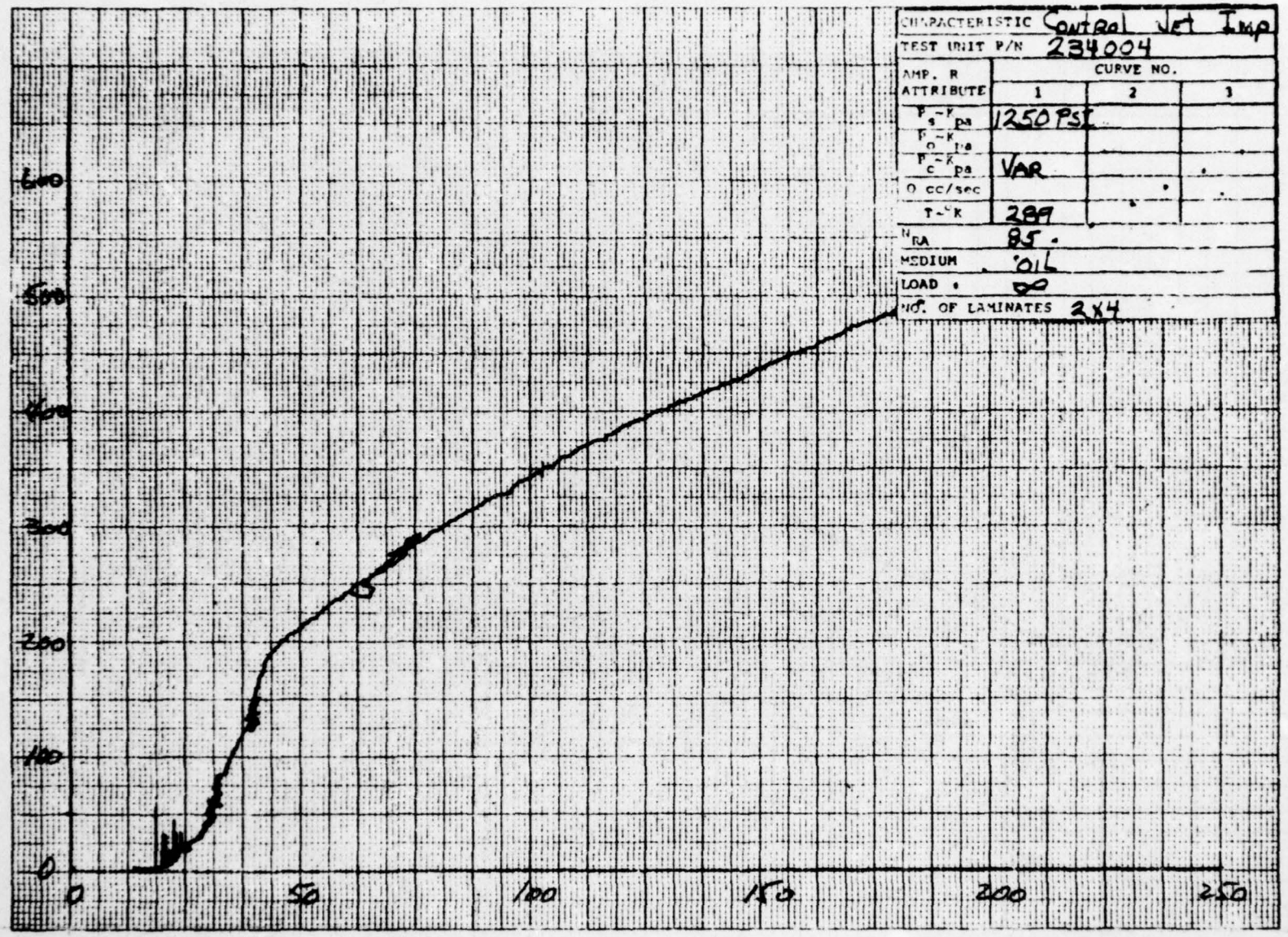

CHARACTERISTIC Control Jet Imp
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s - P_{ps}$
147 PSI
$P_o - P_{ps}$
$P_c - P_{ps}$
VAR
Q cc/sec
T-°R
305
$N_{RA}$
42.5
MEDIUM
oil
LOAD
∞
NO. OF LAMINATES 2X14
0
10
20
30
40
CONTROL PRESS, PSI
503 CONTROL FLOW, lb

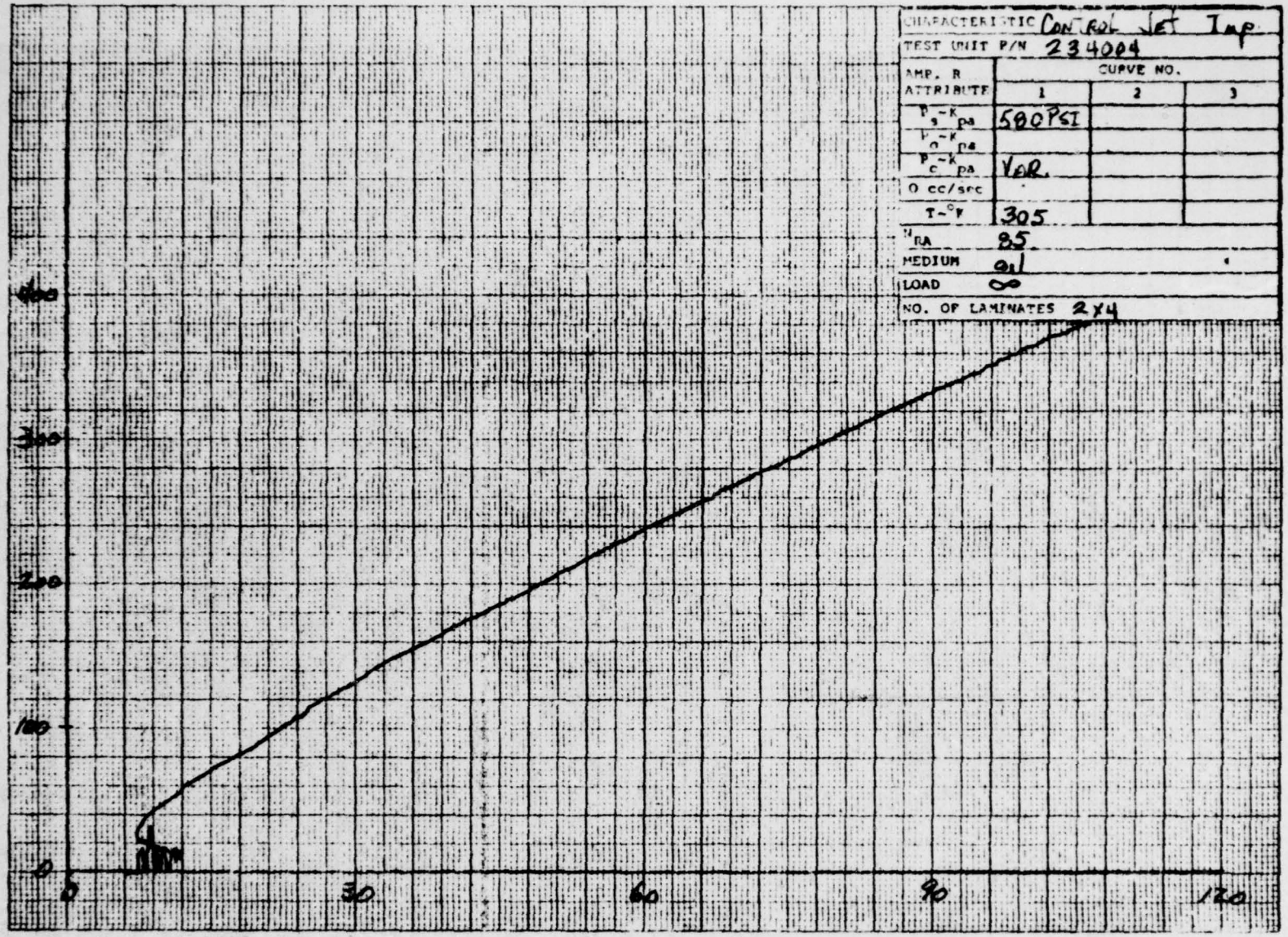


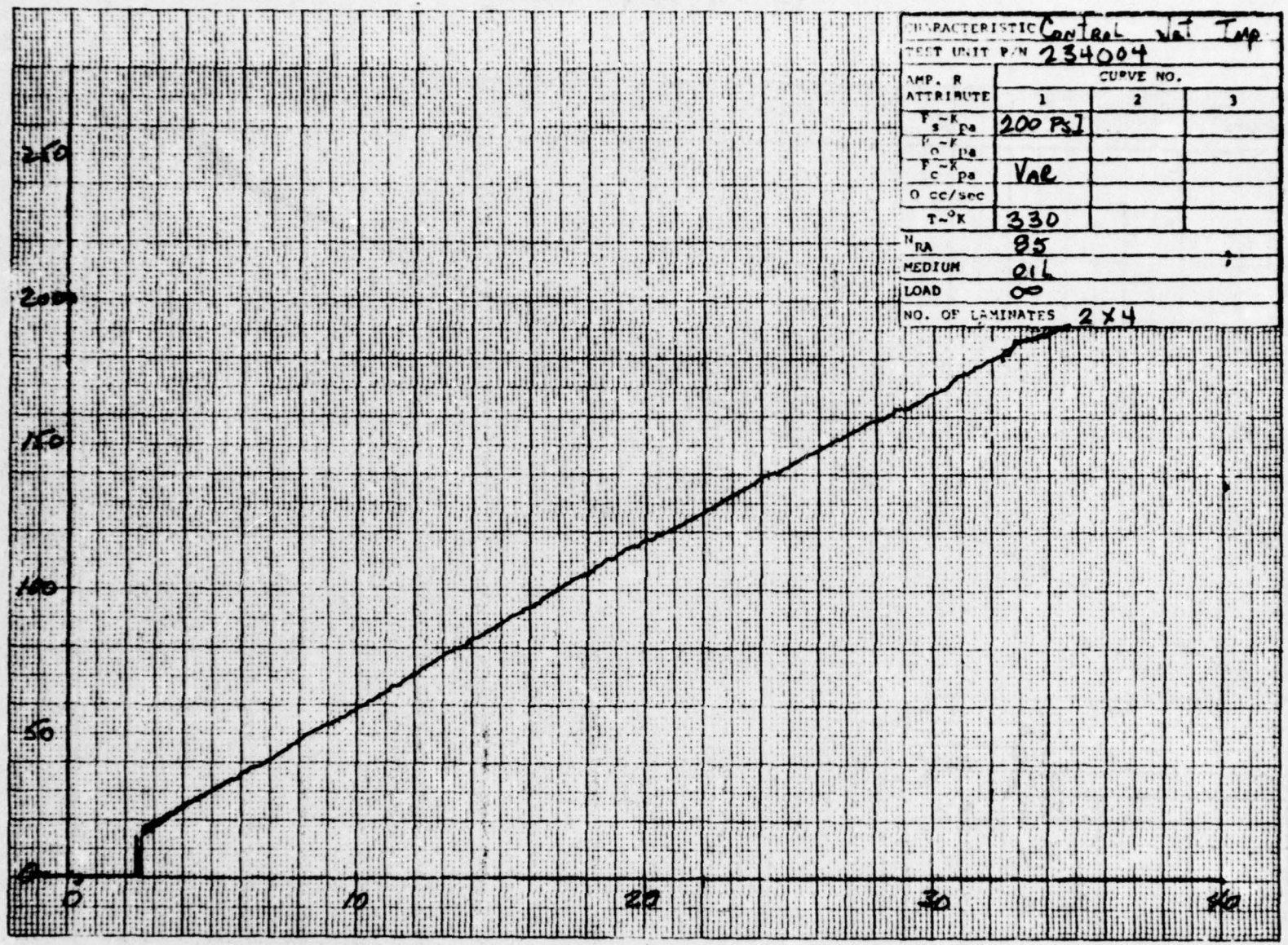

504

CONTROL FLOW, Kg

CONTROL PRESS, PSI


CHARACTERISTIC Control Jet Imp
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s - K_{pa}$ 1250 PSI
$P_o - K_{pa}$
$P_c - K_{pa}$ VAR
0 cc/sec
T-°K 289
$N_{RA}$ 85
MEDIUM OIL
LOAD ∞
NO. OF LAMINATES 2X4
600
500
400
300
200
100
0
0
50
100
150
200
250
505
CONTROL FLOW, Kg
CONTROL PRESS, PSI

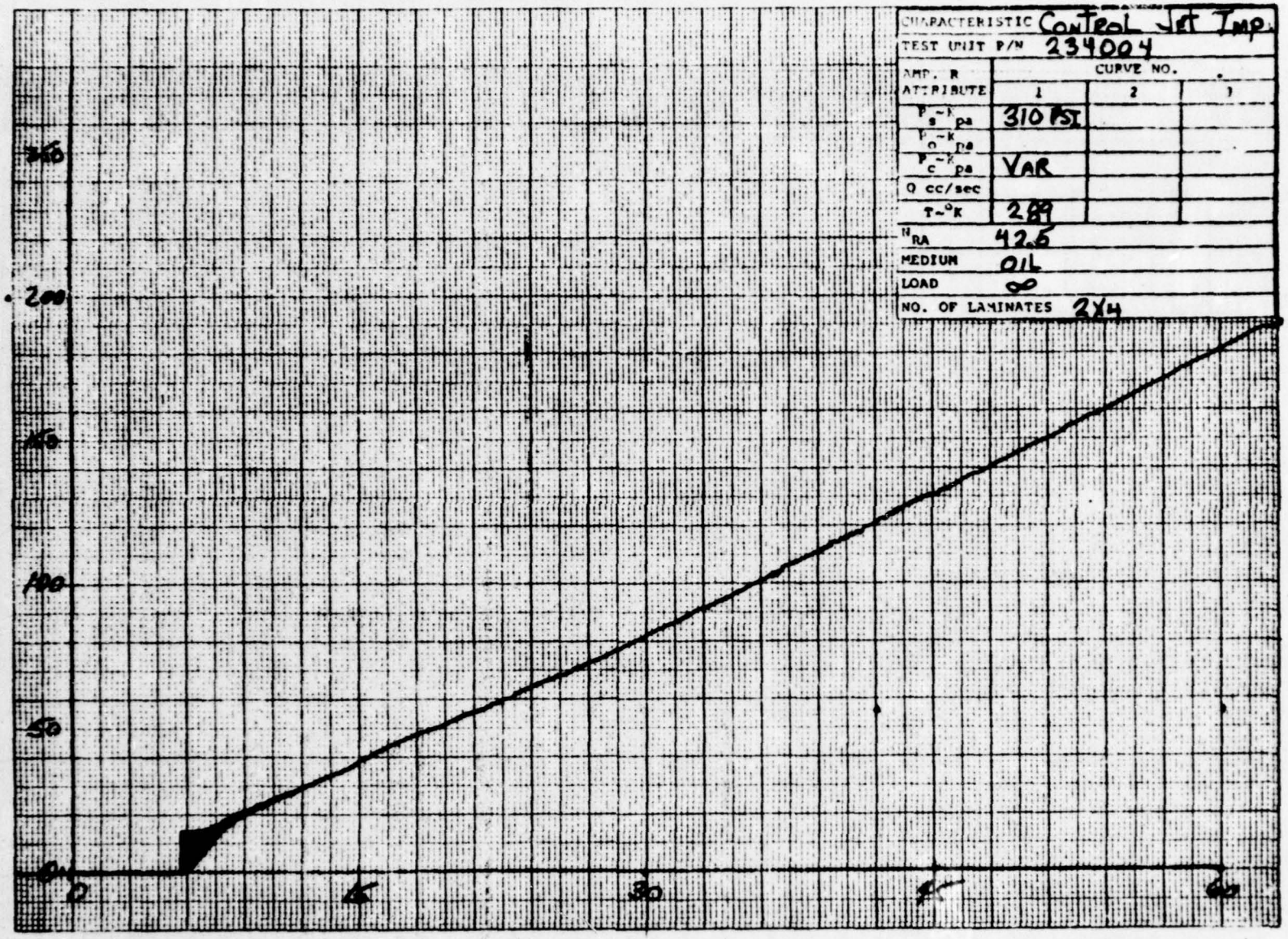

CHARACTERISTIC Control Jet Imp.
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$-K$_{pa}$
580 PSI
$P_o$-K$_{pa}$
$P_c$-K$_{pa}$
VAR.
Q cc/sec
T-°F
305
$N_{pa}$
85
MEDIUM
Oil
LOAD
∞
NO. OF LAMINATES 2X4
400
300
200
100
0
0
30
60
90
120
CONTROL PRESS, PSI
CONTROL FLOW, Q
506



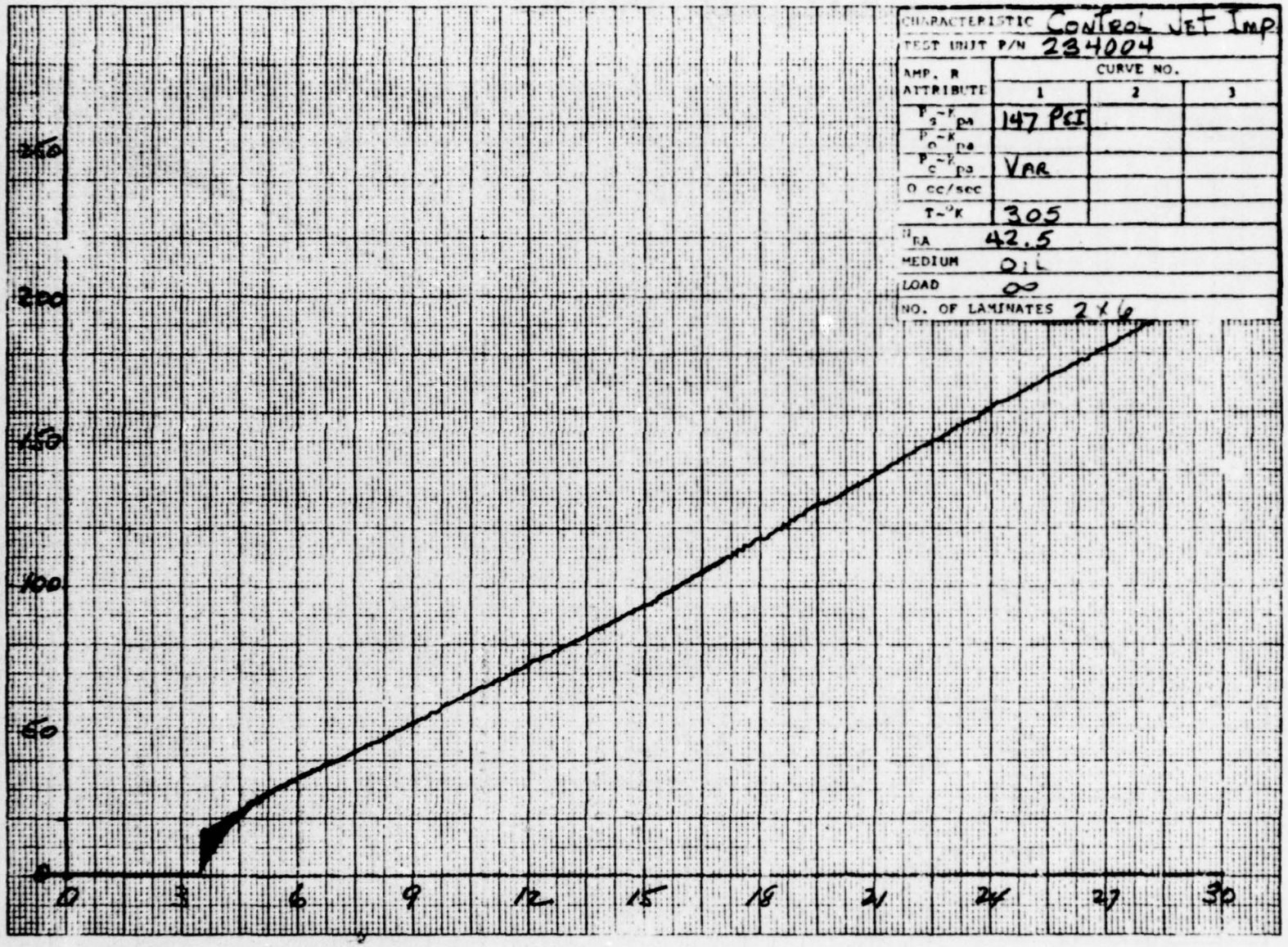

CONTROL FLOW, lbs

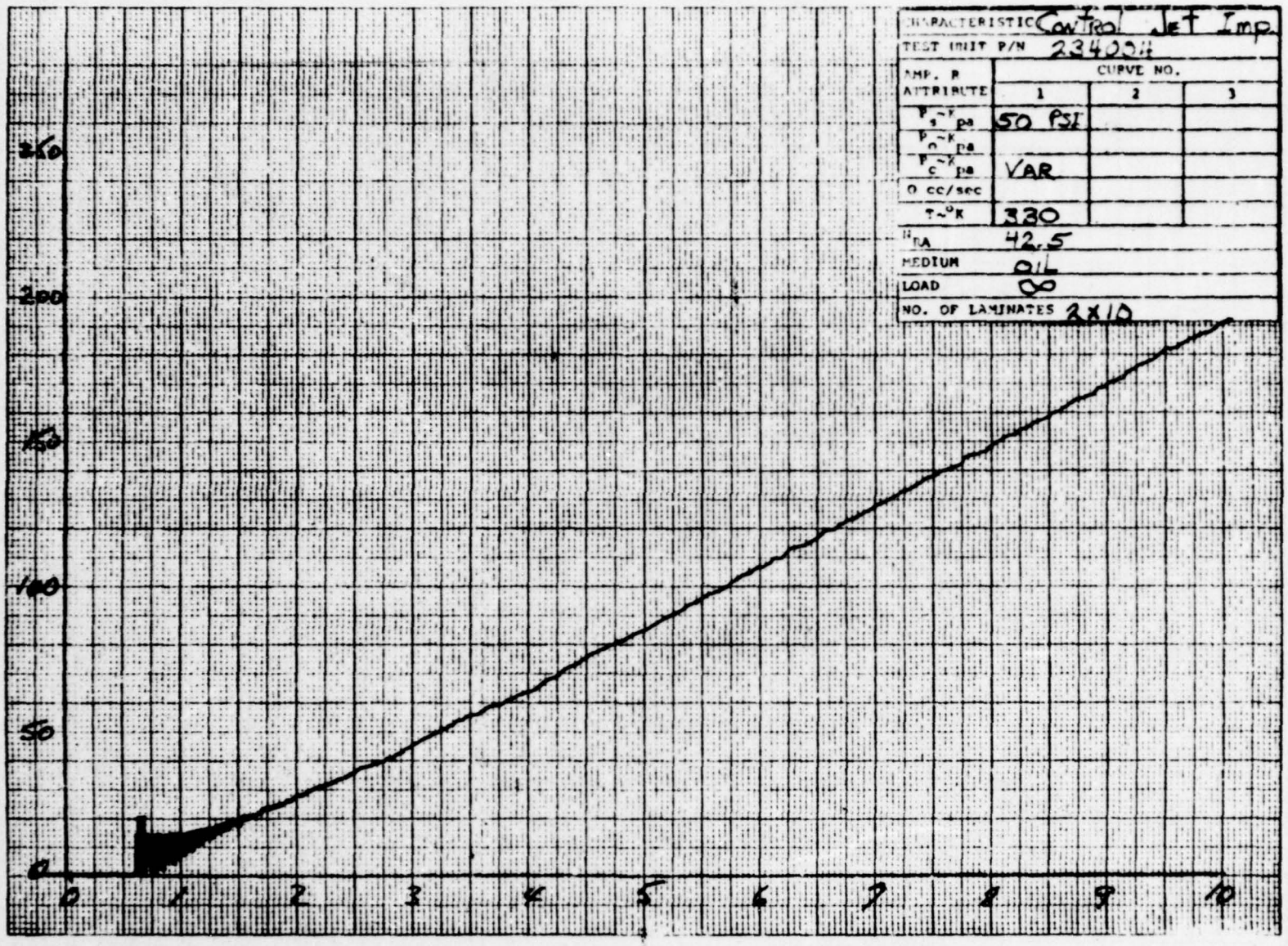
507

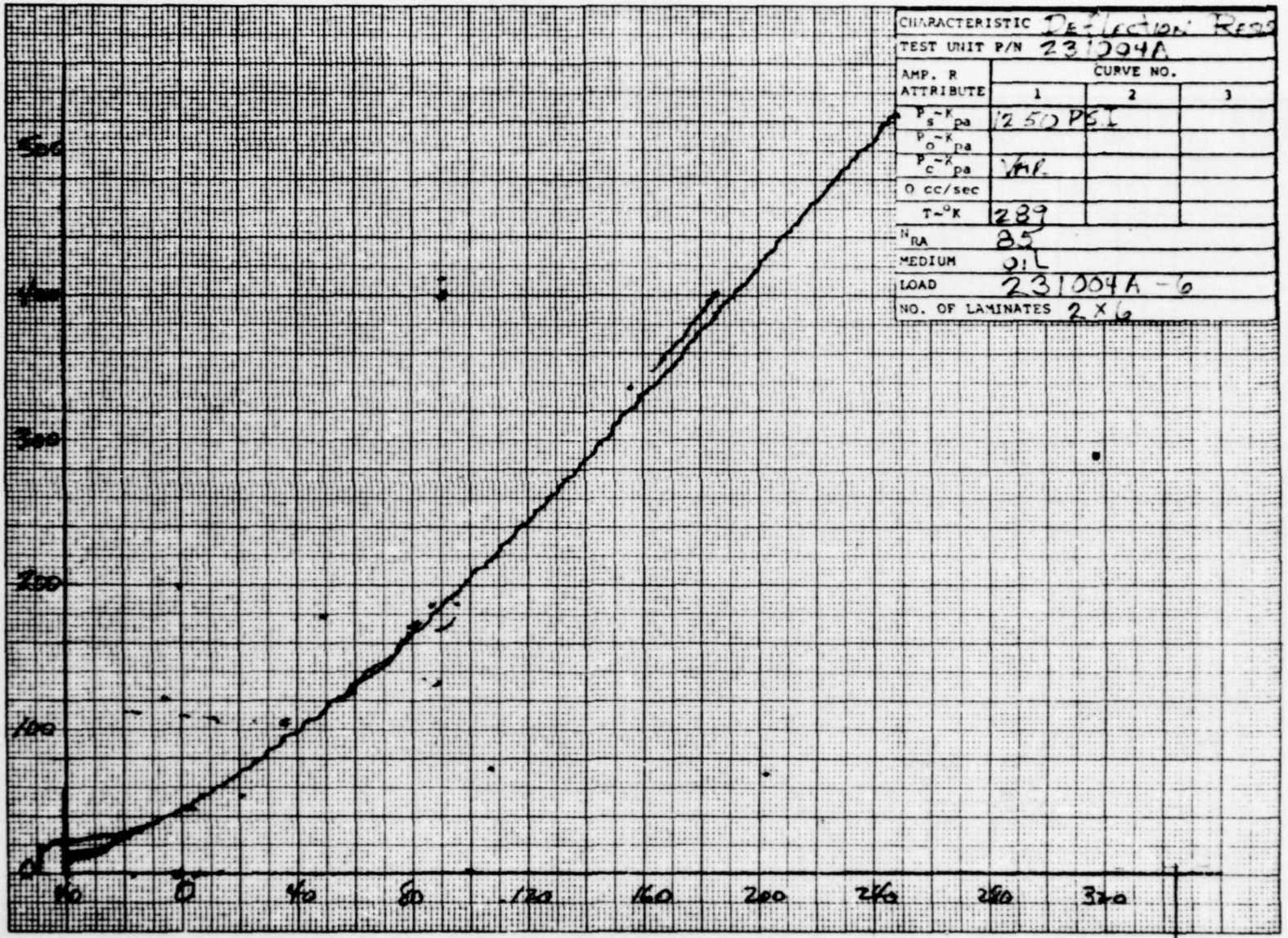
CONTROL PRESS, PSI

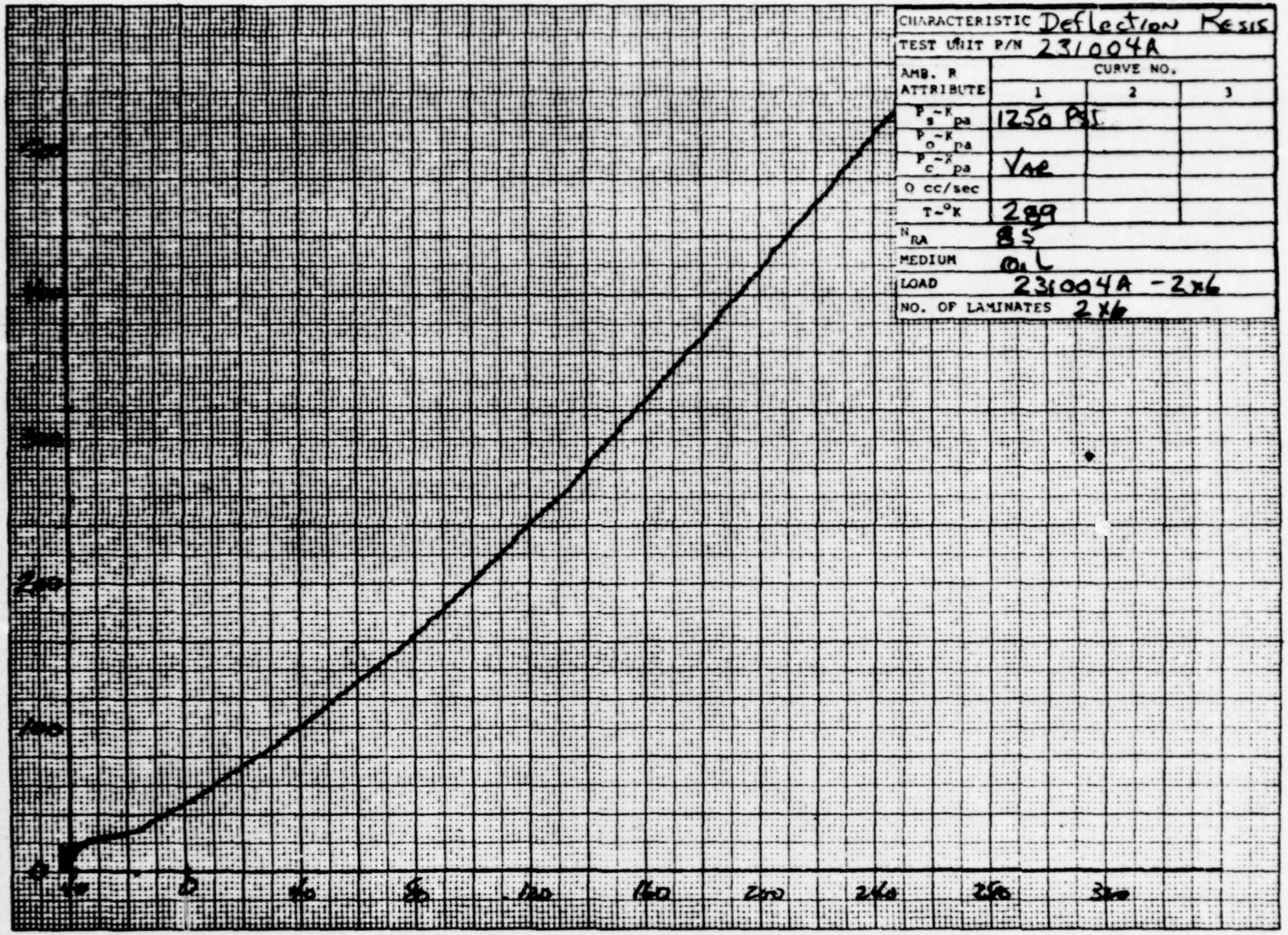

CHARACTERISTIC Control Jet Imp.
TEST UNIT P/N 234004
AMP. R
ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~k pa
310 PSI
$P_o$~k pa
$P_c$~k pa
VAR
Q cc/sec
T~°K
289
$N_{RA}$
42.6
MEDIUM
Oil
LOAD
∞
NO. OF LAMINATES
2X4
200
100
50
0
20
30
40
60
CONTROL FLOW, %
CONTROL PRESS, PSI

805


CHARACTERISTIC CONTROL JET IMP
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s - P_{pa}$ 147 PSI
$P_o - K_{pa}$
$P_c - P_{pa}$ VAR
0 cc/sec
$T - {}^\circ K$ 305
$\eta_{FA}$ 42.5
MEDIUM OIL
LOAD ∞
NO. OF LAMINATES 2 X 6
250
200
150
100
50
0
0
3
6
9
12
15
18
21
24
27
30
CONTROL FLOW, %
509
CONTROL PRESS, PSI


CHARACTERISTIC Control Jet Imp
TEST UNIT P/N 23402-1
AMP. P ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~psi 50 PSI
$P_a$~psi
$P_c$~psi VAR
Q cc/sec
T~°K 330
$N_{DA}$ 42.5
MEDIUM OIL
LOAD ∞
NO. OF LAMINATES 2X10
250
200
150
100
50
0
0 1 2 3 4 5 6 7 8 9 10
CONTROL PRESS, PSI
CONTROL FLOW, Hz
510

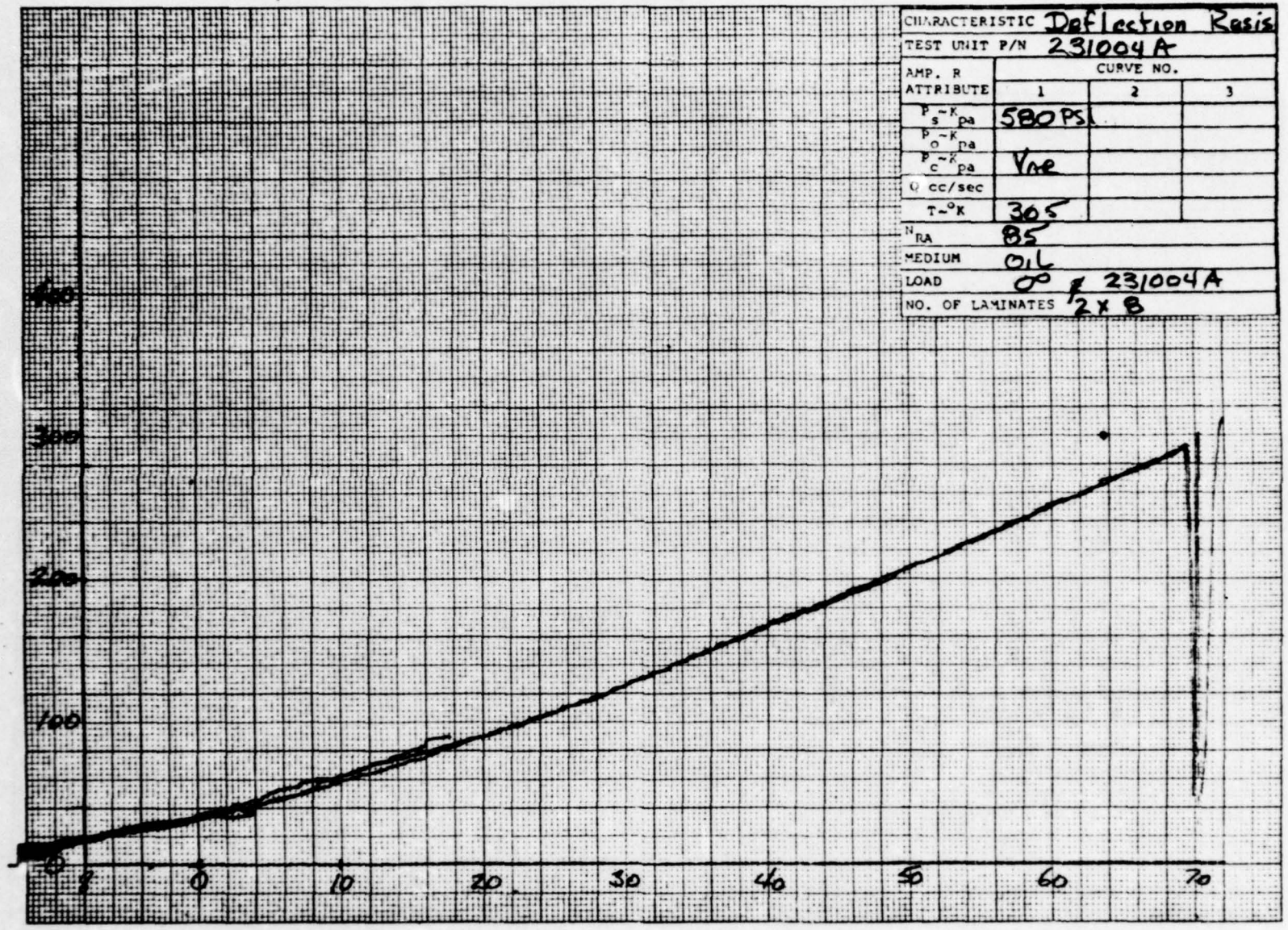

CHARACTERISTIC Deflection Rate
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$ ~ K pa 250 PSI
$P_o$ ~ K pa
$P_c$ ~ K pa Vac.
O cc/sec
T ~ °K 289
$N_{RA}$ 85
MEDIUM Oil
LOAD 231004A-6
NO. OF LAMINATES 2 X 6
500
400
300
200
100
0
40
0
40
80
120
160
200
240
280
320
$\Delta P_c$, PSI
$Q_c$, in$^3$/s
511




$P_{cd}$, psi

512

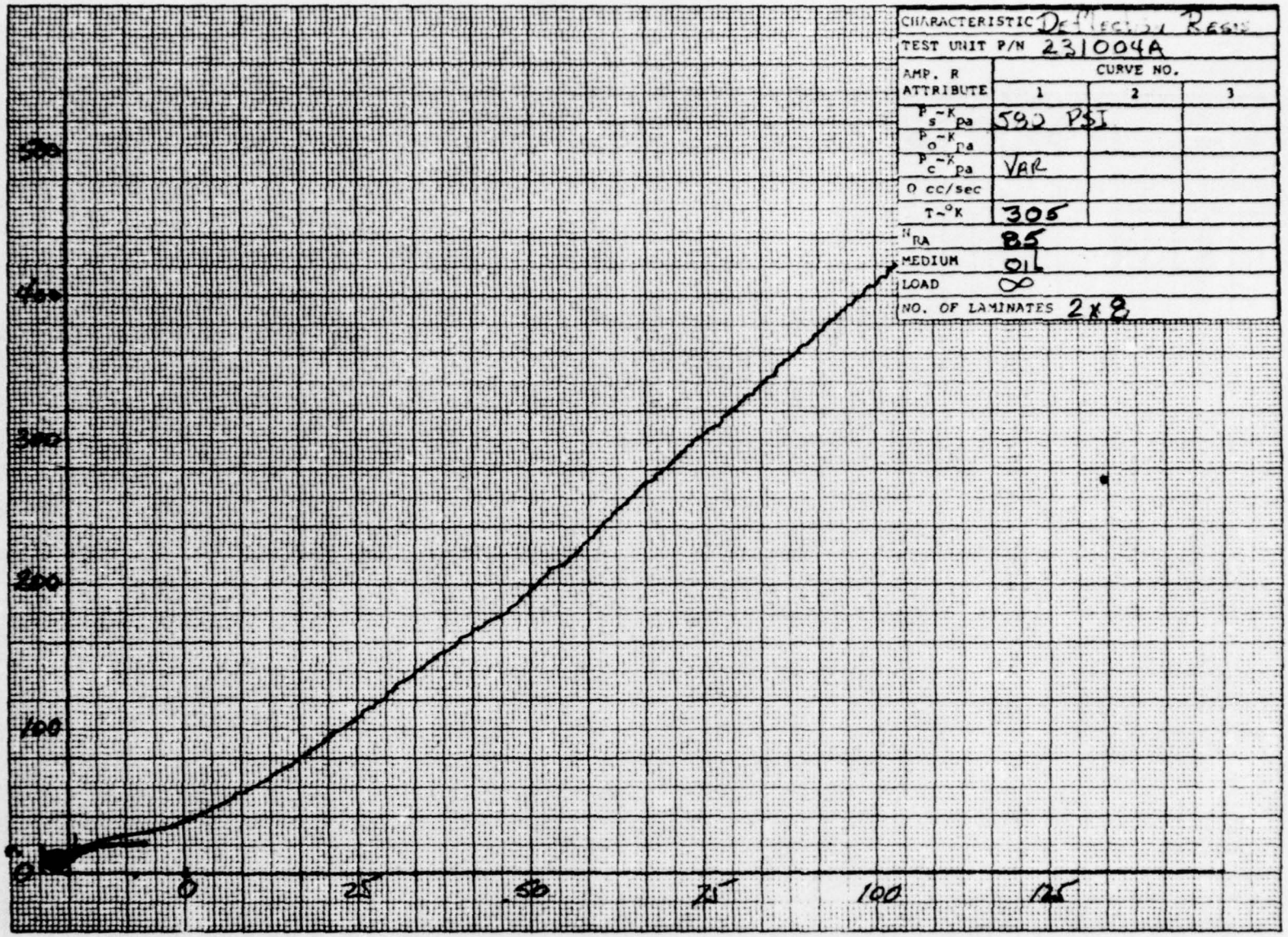
$\Delta P_c$, psi




513

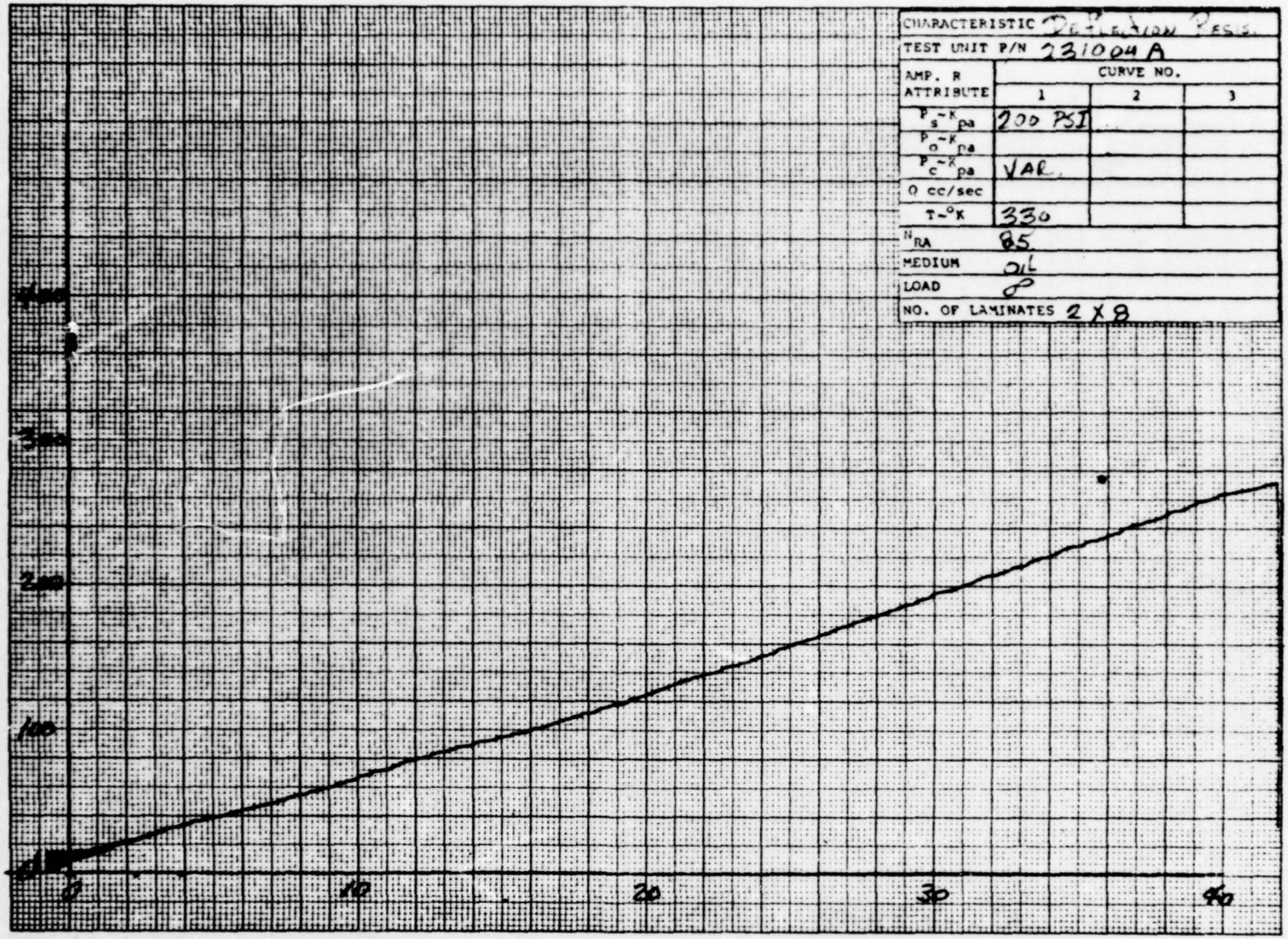
$Q_{cl}$, $H_z$

$\Delta P_c$, psi




514

CLEARPRINT PAPER CO. NO. C30 MILLIMETERS BOTH WAYS 100 X 130 DIVISIONS
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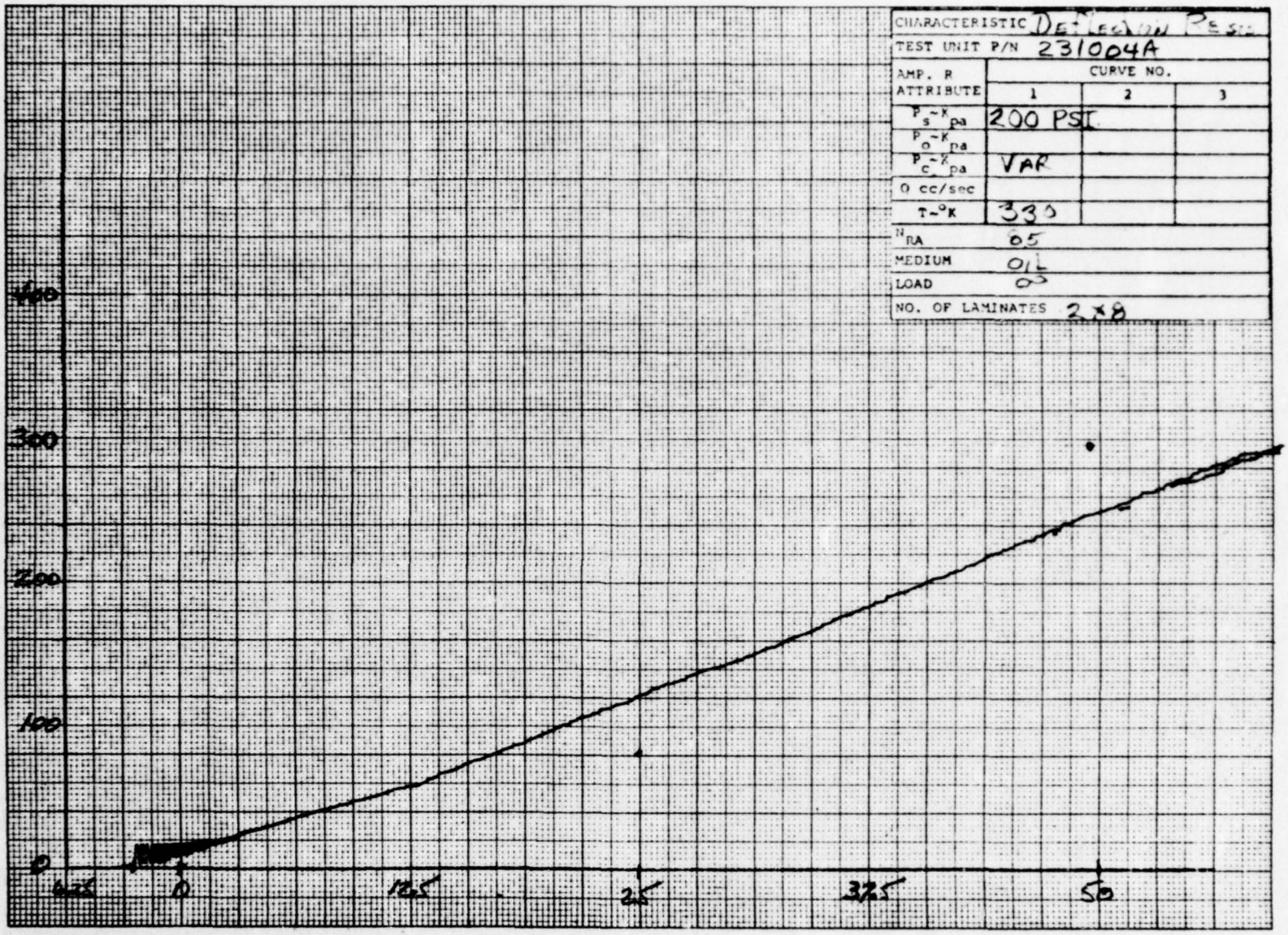



$P_c$, Hz

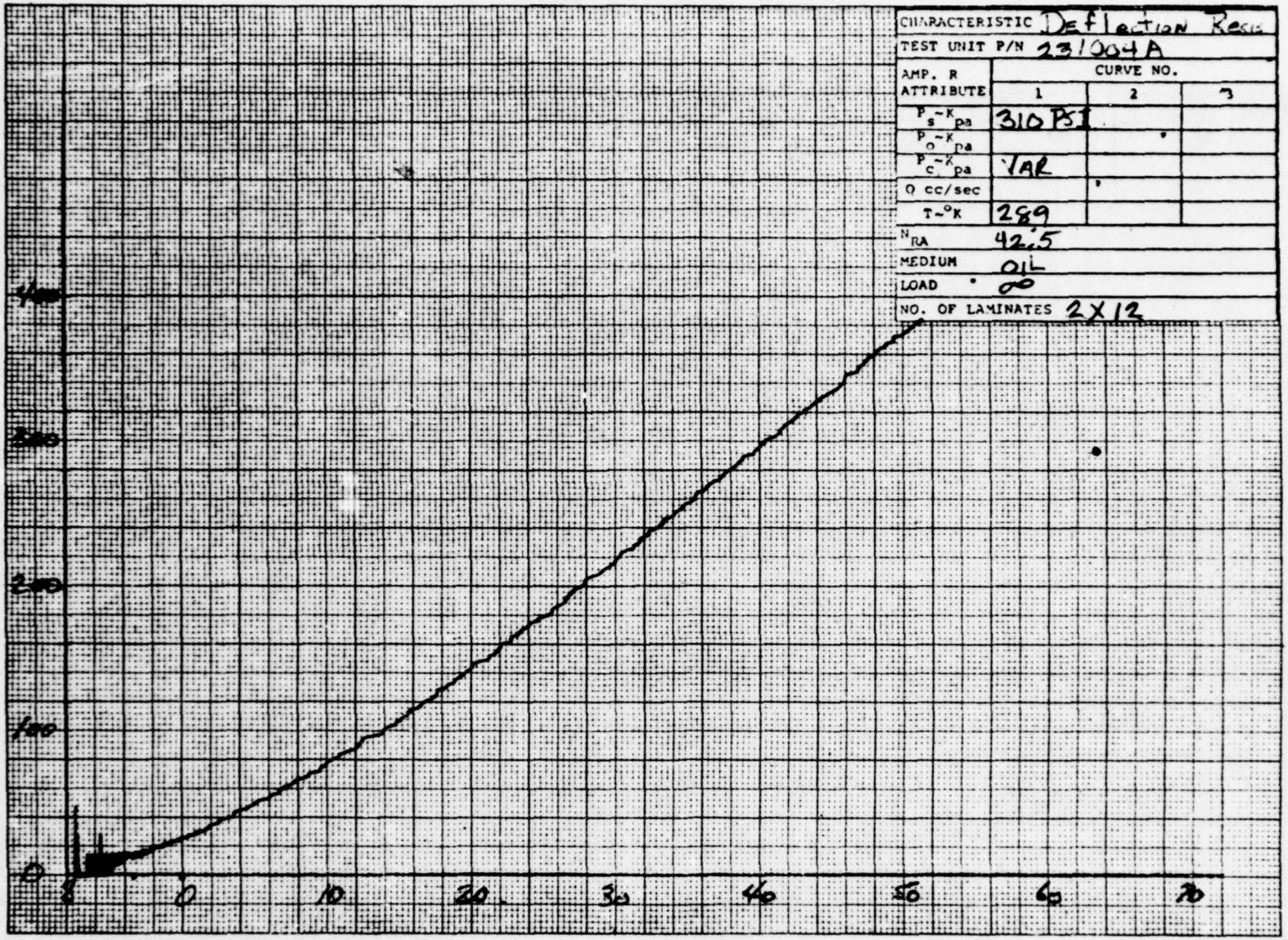
$\Delta P_c$, psi

515

KEUFFEL & ESSER CO. NO. C38 MILLIMETERS BOTH WAYS 180 X 250 DIVISIONS
PRINTED IN U.S.A. ON CLEARPRINT TECHNICAL PAPER NO. 1018


CHARACTERISTIC DEFLECTION PRESS
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa 200 PSI
$P_o$~K pa
$P_c$~K pa VAR
0 cc/sec
T~°K 330
$N_{RA}$ 05
MEDIUM 01
LOAD 03
NO. OF LAMINATES 2x8
400
300
200
100
0
-.25
0
12.5
25
37.5
50
$\dot{Q}_{c2}$, %
$\Delta P_c$, PSI

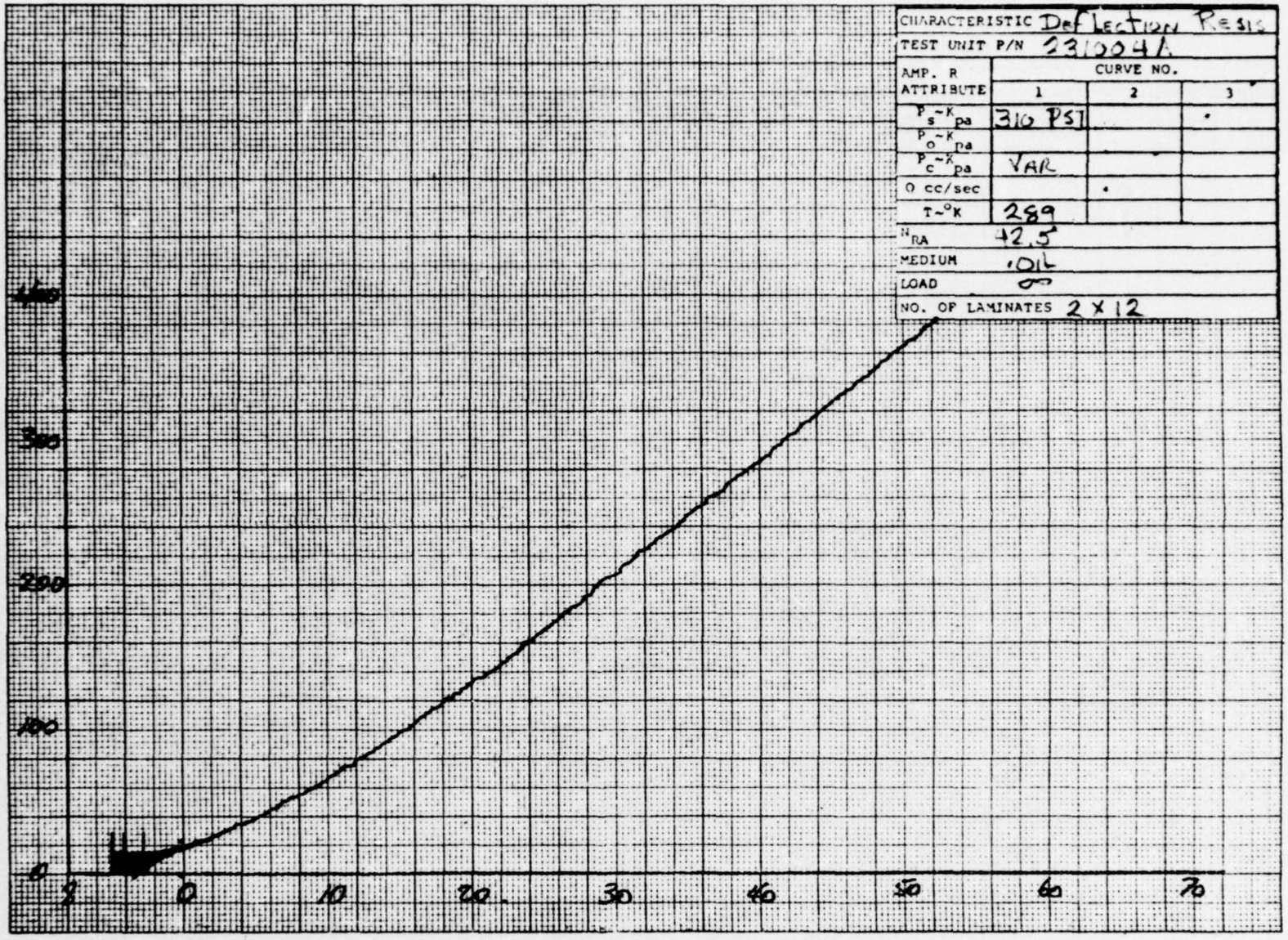
516




$\Delta P_c$ , PSI

S17

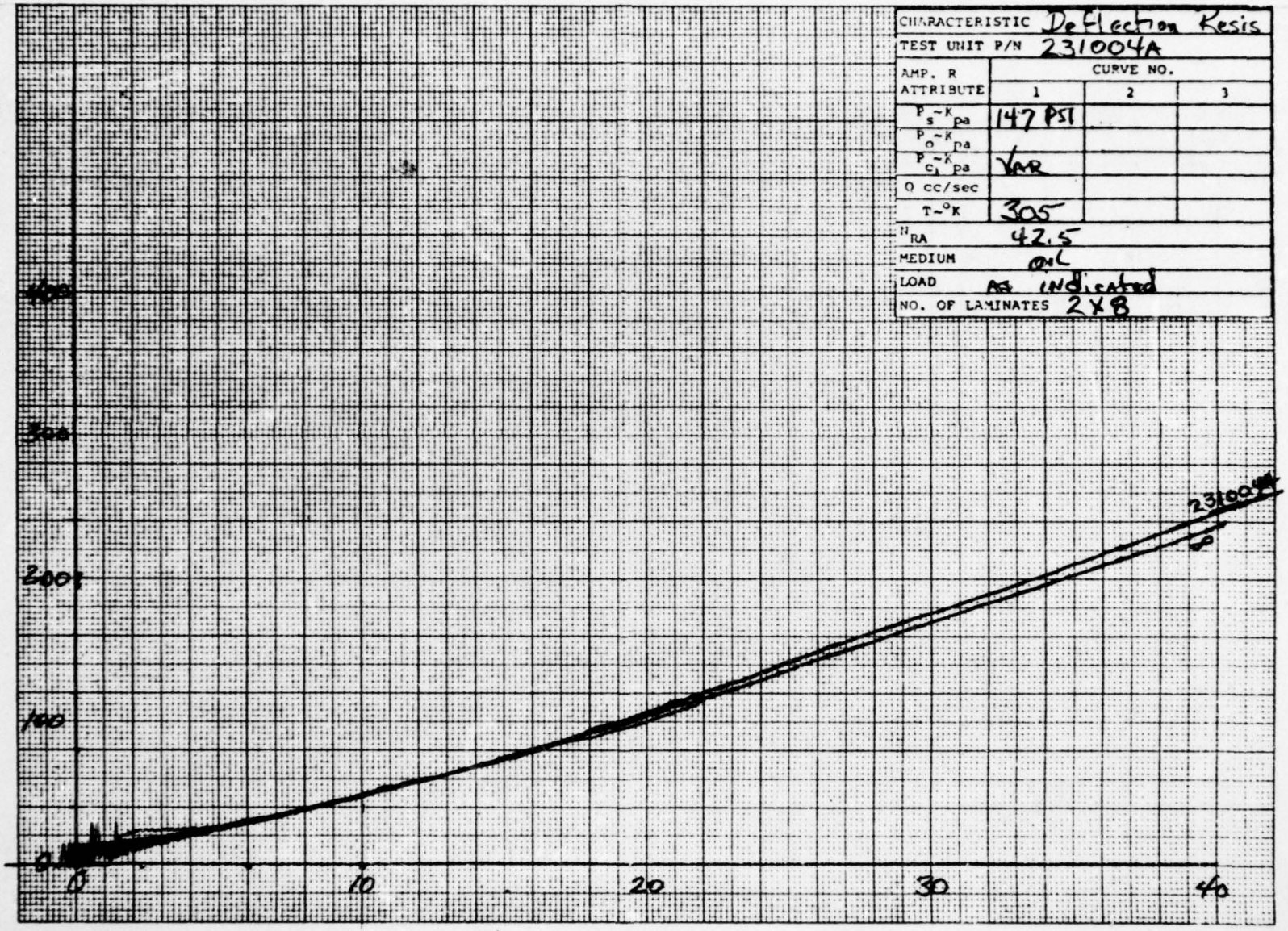
$Q_{cl}$ , $H_3$




518

$Q_{cc}$, Hz

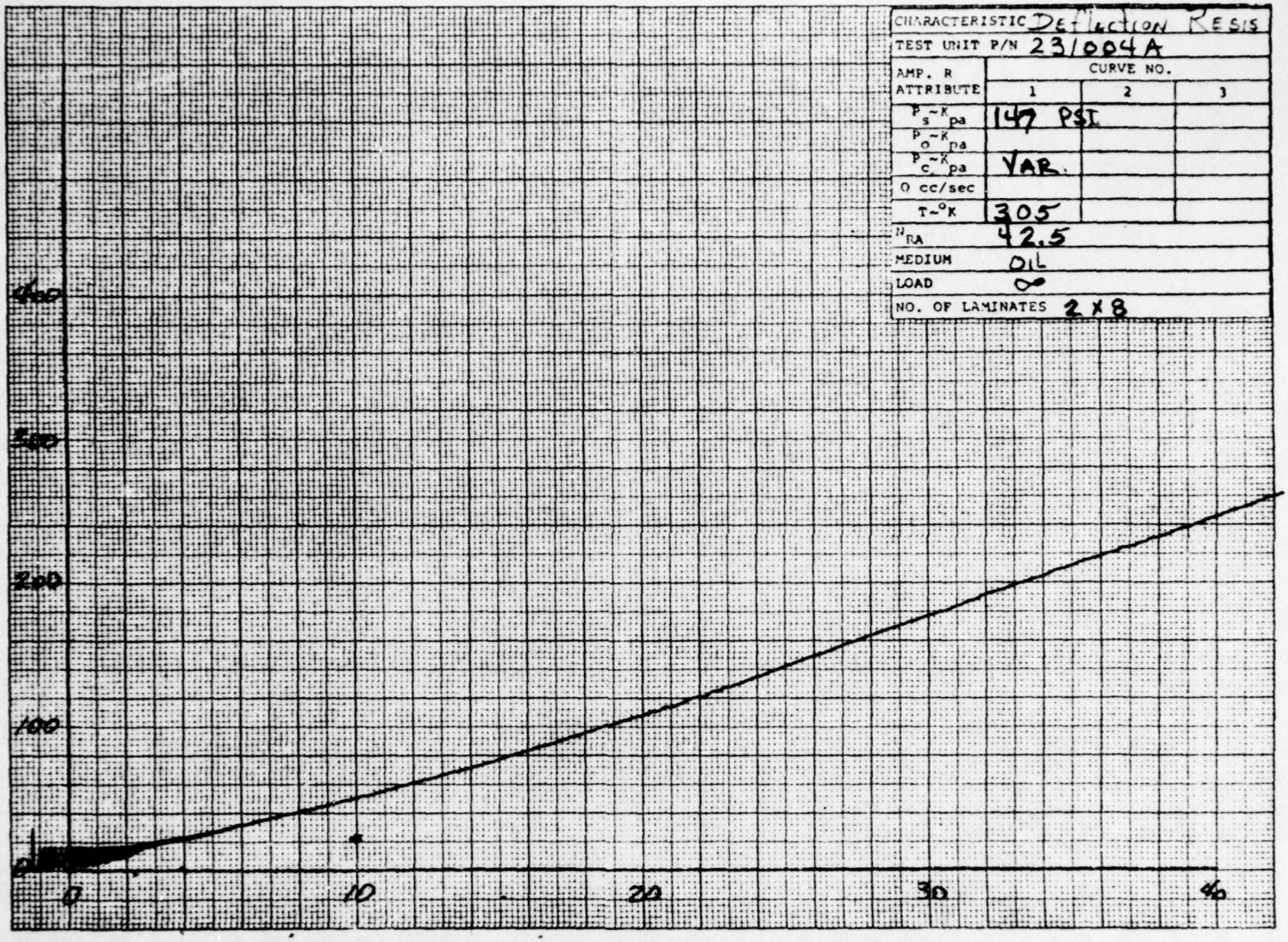
$\Delta P_c$, psi


CHARACTERISTIC Deflection Resis
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~Kpa 147 PSI
$P_o$~Kpa
$P_{c_1}$~Kpa VAR
0 cc/sec
T~°K 305
$N_{RA}$ 42.5
MEDIUM Oil
LOAD As Indicated
NO. OF LAMINATES 2X8
231004
0
0
100
200
300
400
10
20
30
40
$\Delta P_c$ , psi

519

Qii, Hz

| CHARACTERISTIC | Deflection Resis | | |
|---|---|---|---|
| TEST UNIT P/N | 23004A | | |
| AMP. R ATTRIBUTE | CURVE NO. 1 | 2 | 3 |
| $P_s$ ~ K pa | 147 PSI | | |
| $P_o$ ~ K pa | | | |
| $P_c$ ~ K pa | VAR. | | |
| Q cc/sec | | | |
| T ~ °K | 305 | | |
| $N_{RA}$ | 42.5 | | |
| MEDIUM | OIL | | |
| LOAD | ∞ | | |
| NO. OF LAMINATES | 2 X 8 | | |

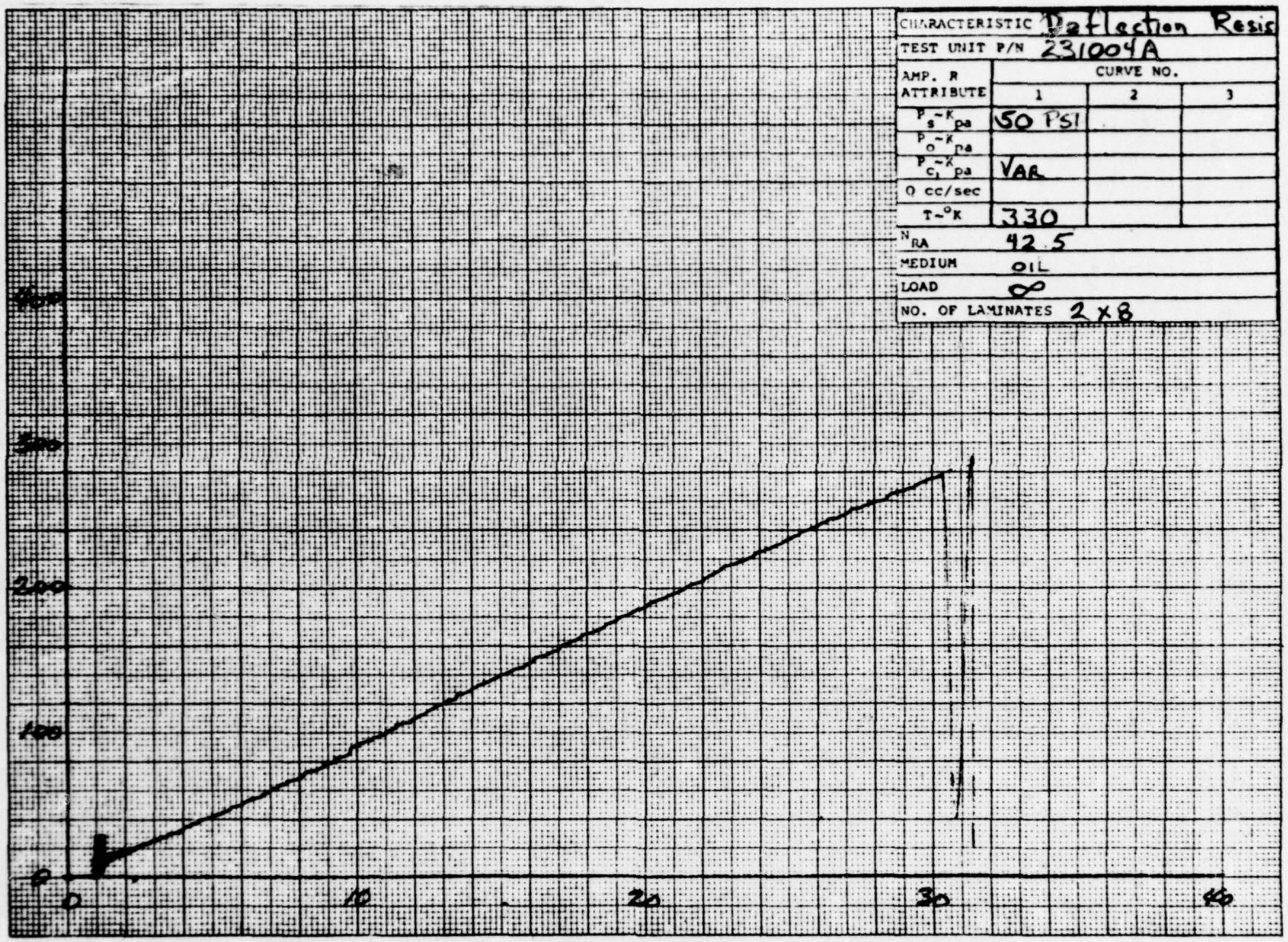



$Q_{cc}$, $H_2$

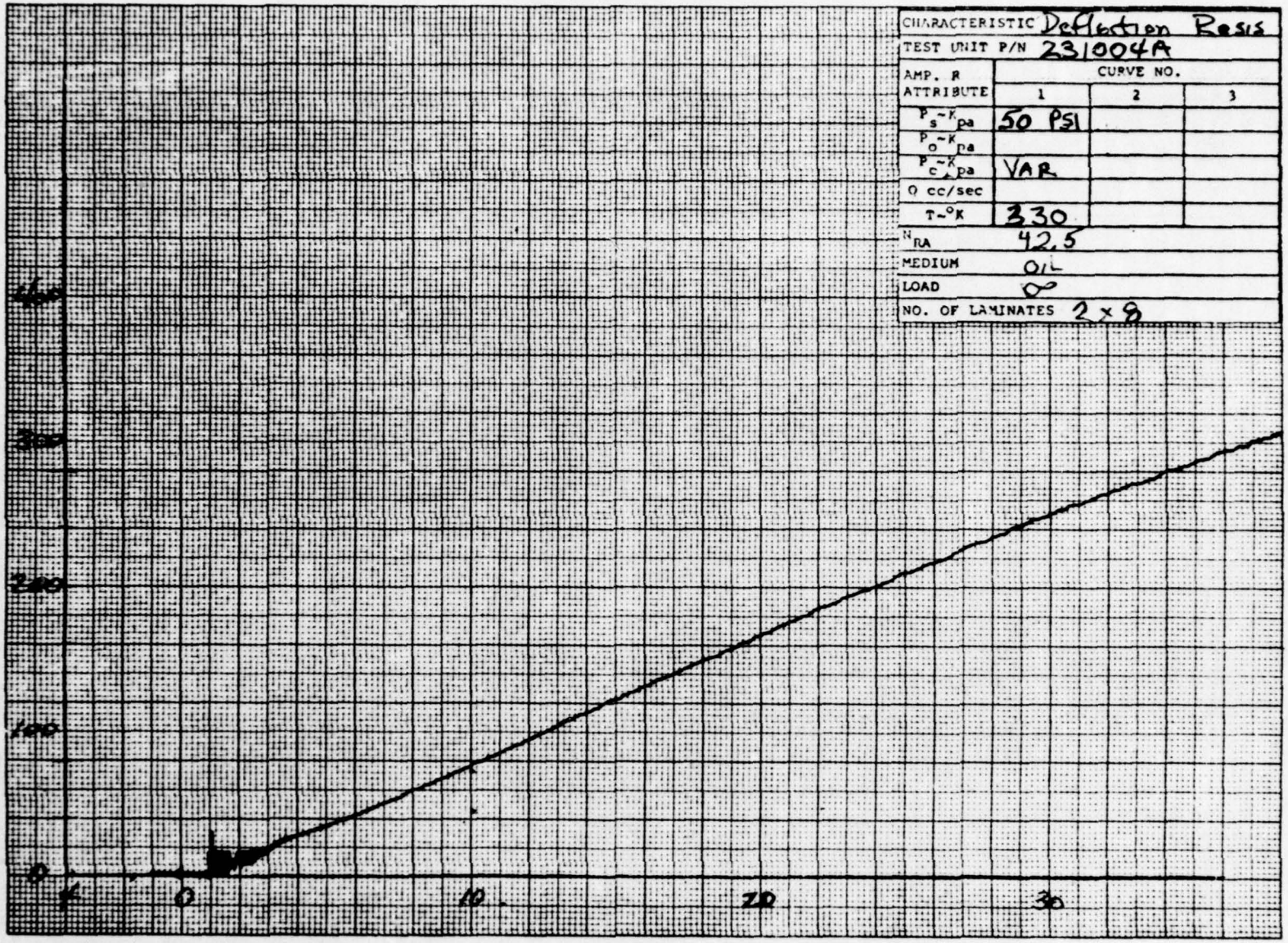
520

$\Delta P_c$, psi

KEUFFEL & ESSER CO. NO. 358 MILLIMETERS BOTH WAYS 180 X 250 DIVISIONS
PRINTED IN U.S.A. ON KEUFFEL TECHNICAL PAPER NO. 1018


CHARACTERISTIC Deflection Resis
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~$K_{pa}$ 50 PSI
$P_o$~$K_{pa}$
$P_{c_1}$~$K_{pa}$ VAR
Q cc/sec
T~°K 330
$N_{RA}$ 42.5
MEDIUM OIL
LOAD ∞
NO. OF LAMINATES 2 X 8
200
100
0
0
10
20
30
40
$Q_{c_1}$, in³/sec
$\Delta P_c$, psi

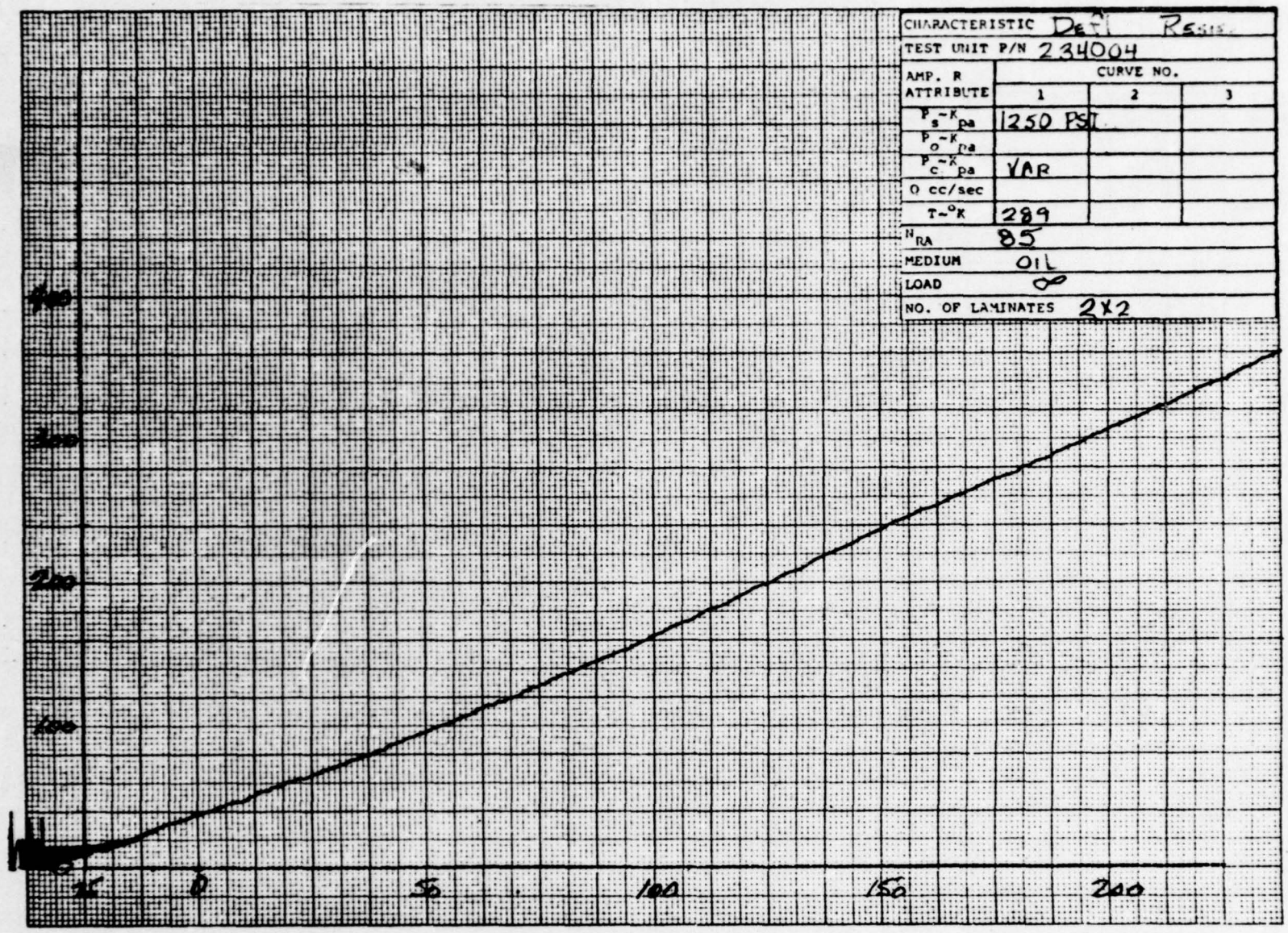
521



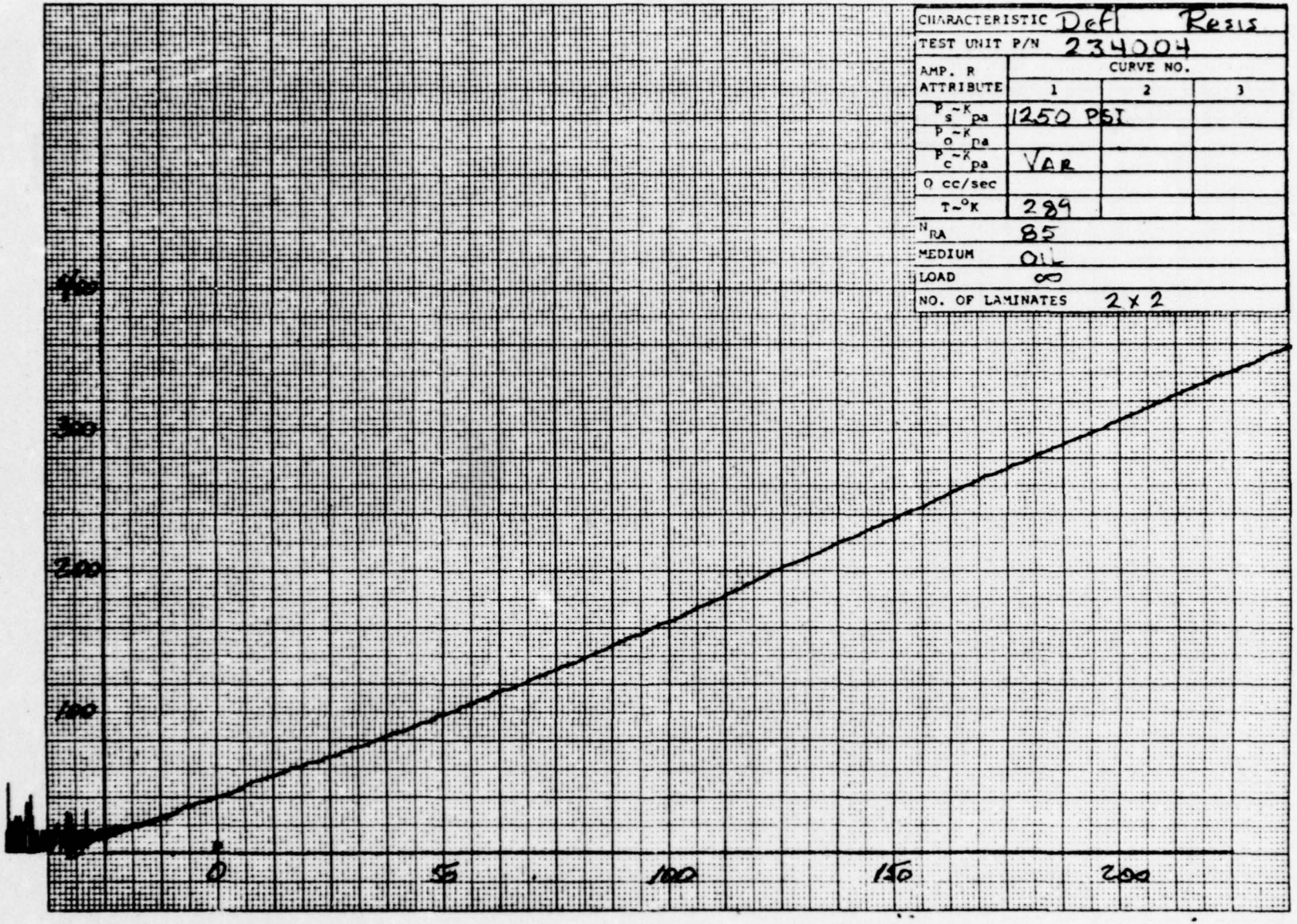

522

$\Delta P_c$ psi

CRANE CHART
PRINTED IN U.S.A. ON CRANE'S TECHNICAL PAPER NO. 1012
CRANE'S TECHNICAL PAPER CO. NO. C38 MILLIMETERS BOTH WAYS 100 X 250 DIVISIONS


CHARACTERISTIC DEFL RESP.
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$-KPa 1250 PSI
$P_o$-KPa
$P_c$-KPa VAR
0 cc/sec
T-°K 289
$N_{RA}$ 85
MEDIUM OIL
LOAD ∞
NO. OF LAMINATES 2X2
-50
0
50
100
150
200
$P_c$, Hz
.523
$\Delta P_c$, PSI

| CHARACTERISTIC | Def Resis | | |
|---|---|---|---|
| TEST UNIT P/N | 234004 | | |
| AMP. R ATTRIBUTE | CURVE NO. 1 | 2 | 3 |
| $P_s$~$K_{pa}$ | 1250 PSI | | |
| $P_o$~$K_{pa}$ | | | |
| $P_c$~$K_{pa}$ | VAR | | |
| Q cc/sec | | | |
| T~°K | 289 | | |
| $N_{RA}$ | 85 | | |
| MEDIUM | OIL | | |
| LOAD | ∞ | | |
| NO. OF LAMINATES | 2 x 2 | | |

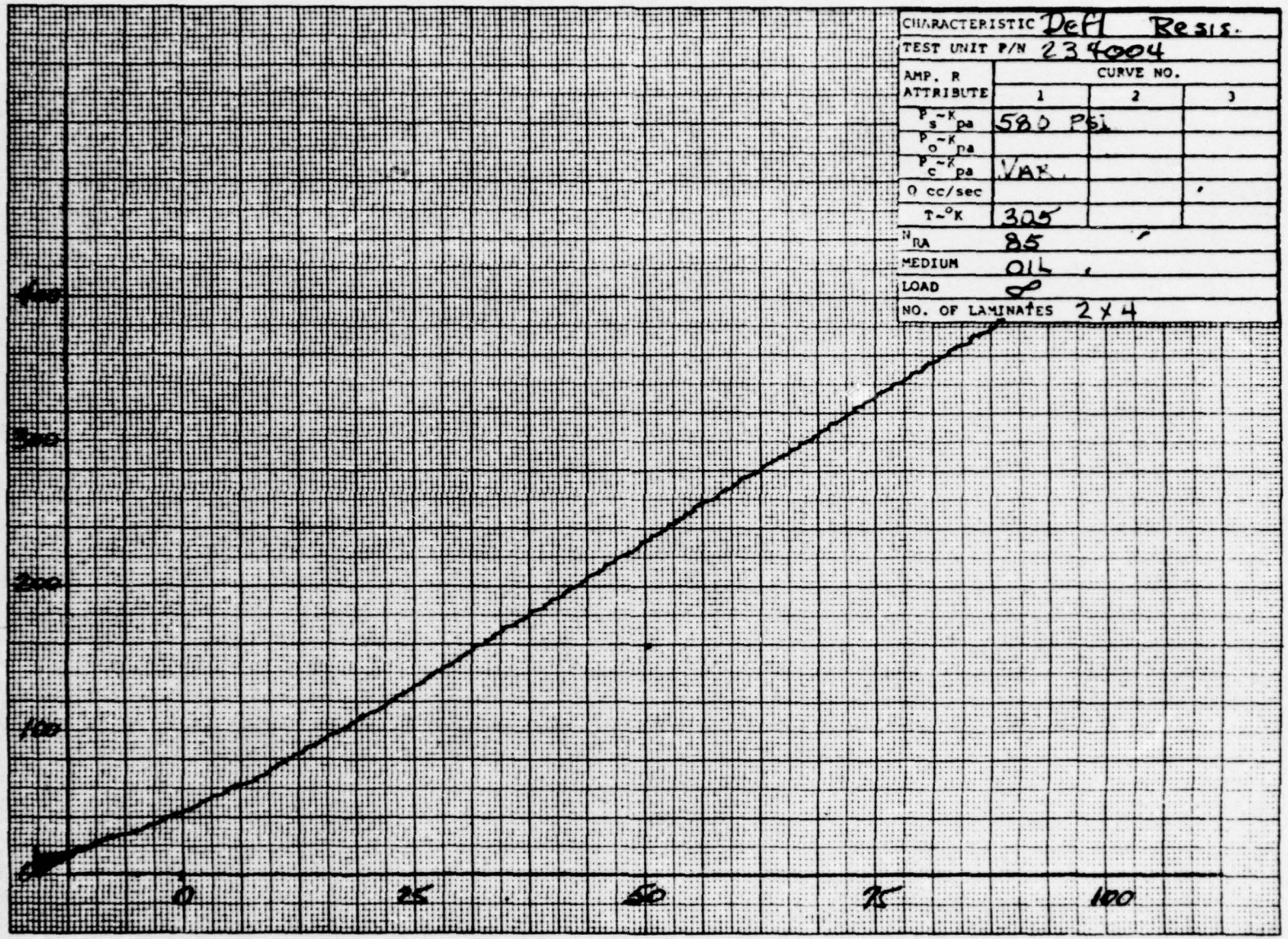


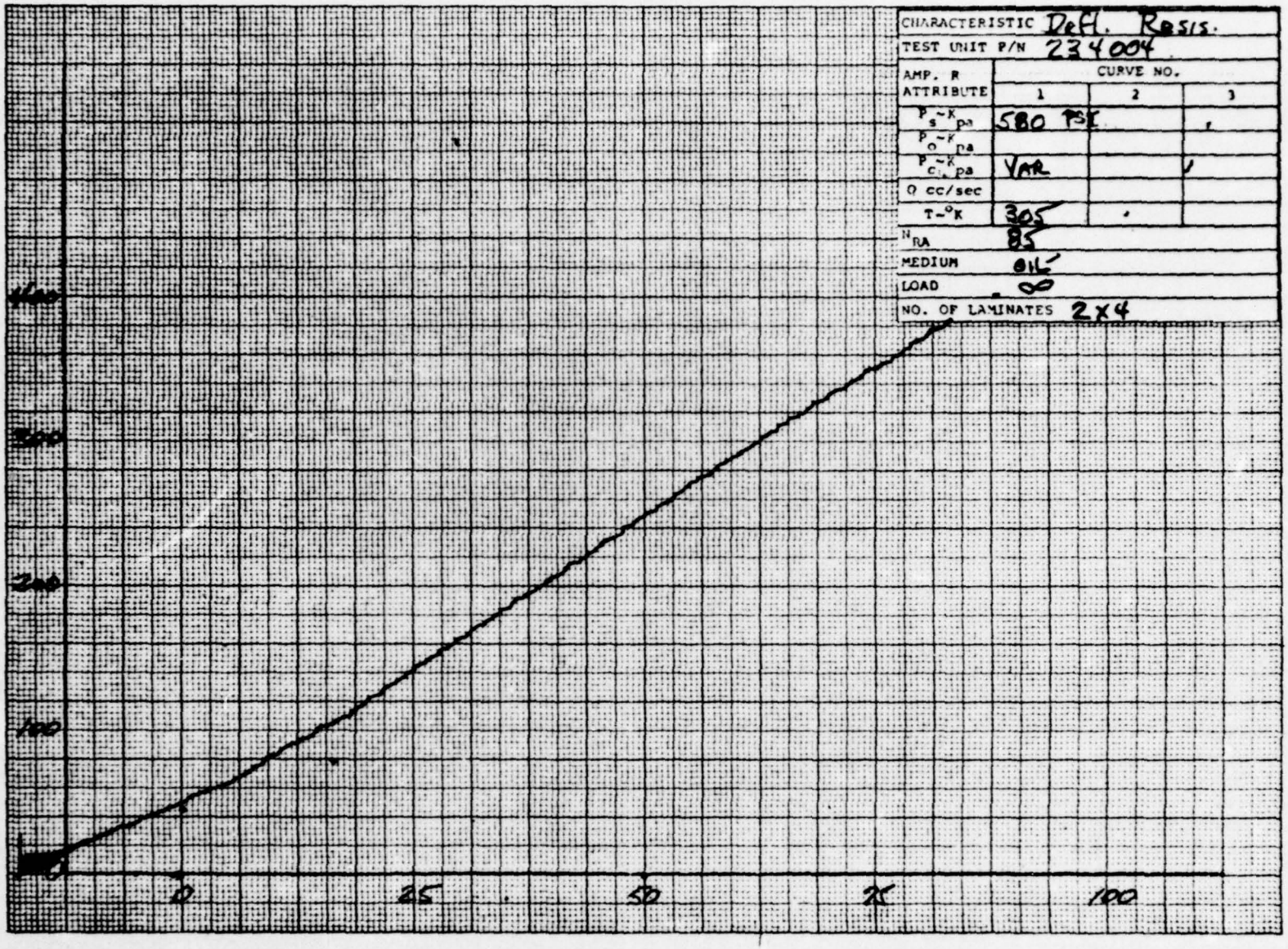

$Q_{c_2}$, lb/s

$\Delta P_c$, psi

524

KEUFFEL & ESSER CO. NO. 358 MILLIMETERIA BOTH WAYS 180 X 250 DIVISIONS
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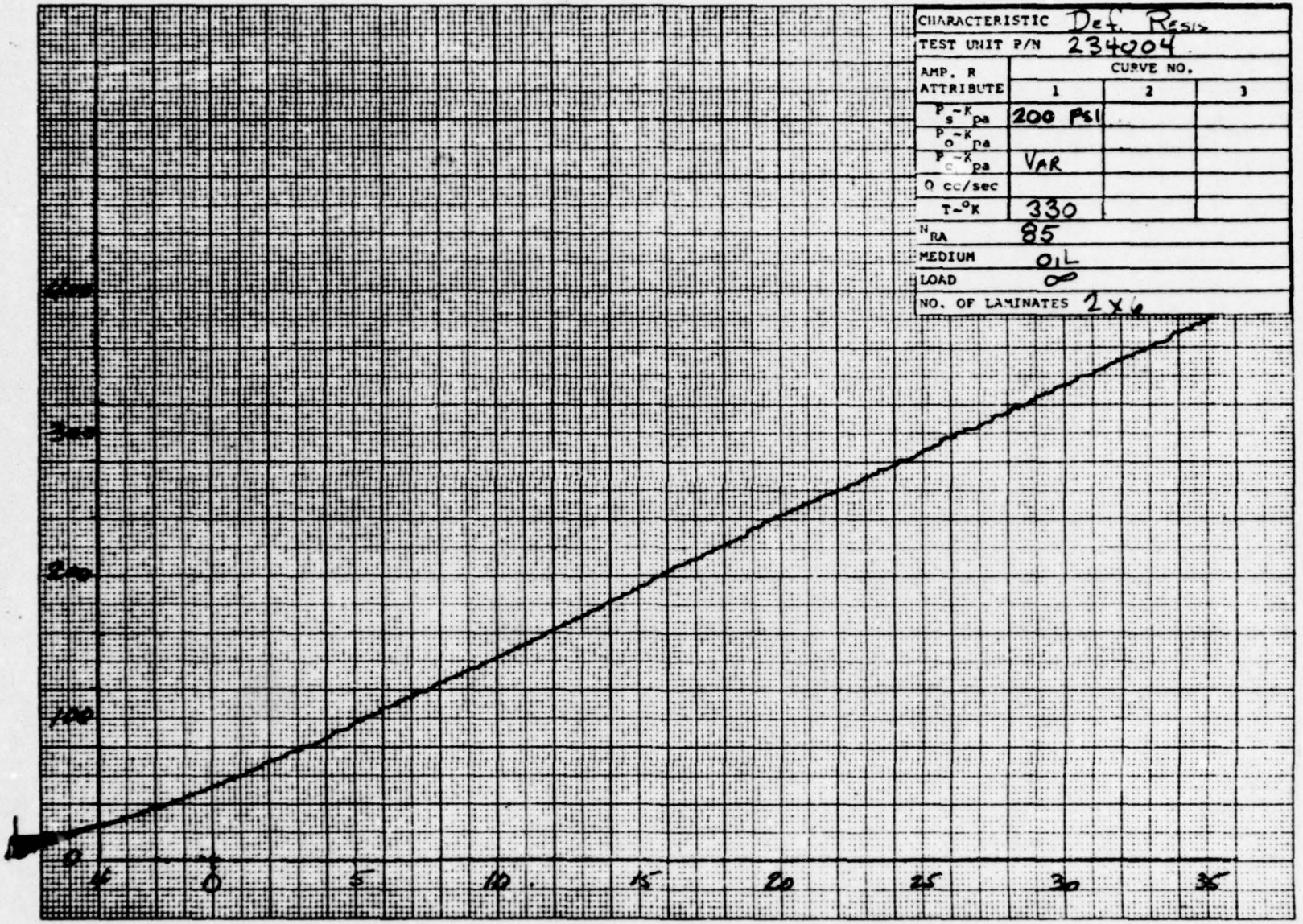

CHARACTERISTIC Def Resis.
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa 580 psi
$P_o$~K pa
$P_c$~K pa VAR.
Q cc/sec
T~°K 325
$N_{RA}$ 85
MEDIUM OIL
LOAD 8
NO. OF LAMINATES 2 X 4
400
300
200
100
0
0
25
50
75
100
525
$Q_c$, Hz
$\Delta P_c$, psi



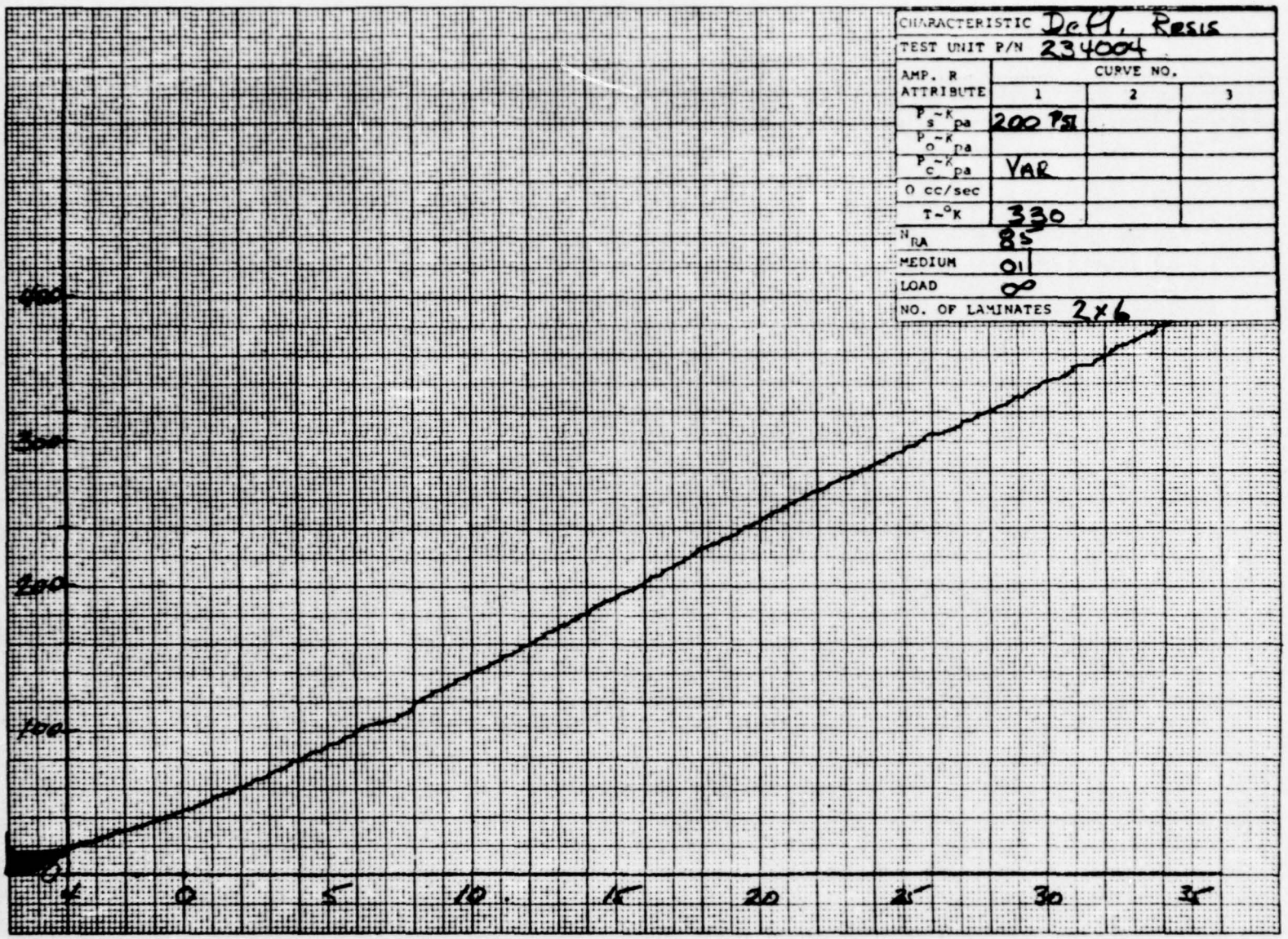

$\Delta P_c$, psi

$Q_{c_2}$, $\frac{lb}{sec}$

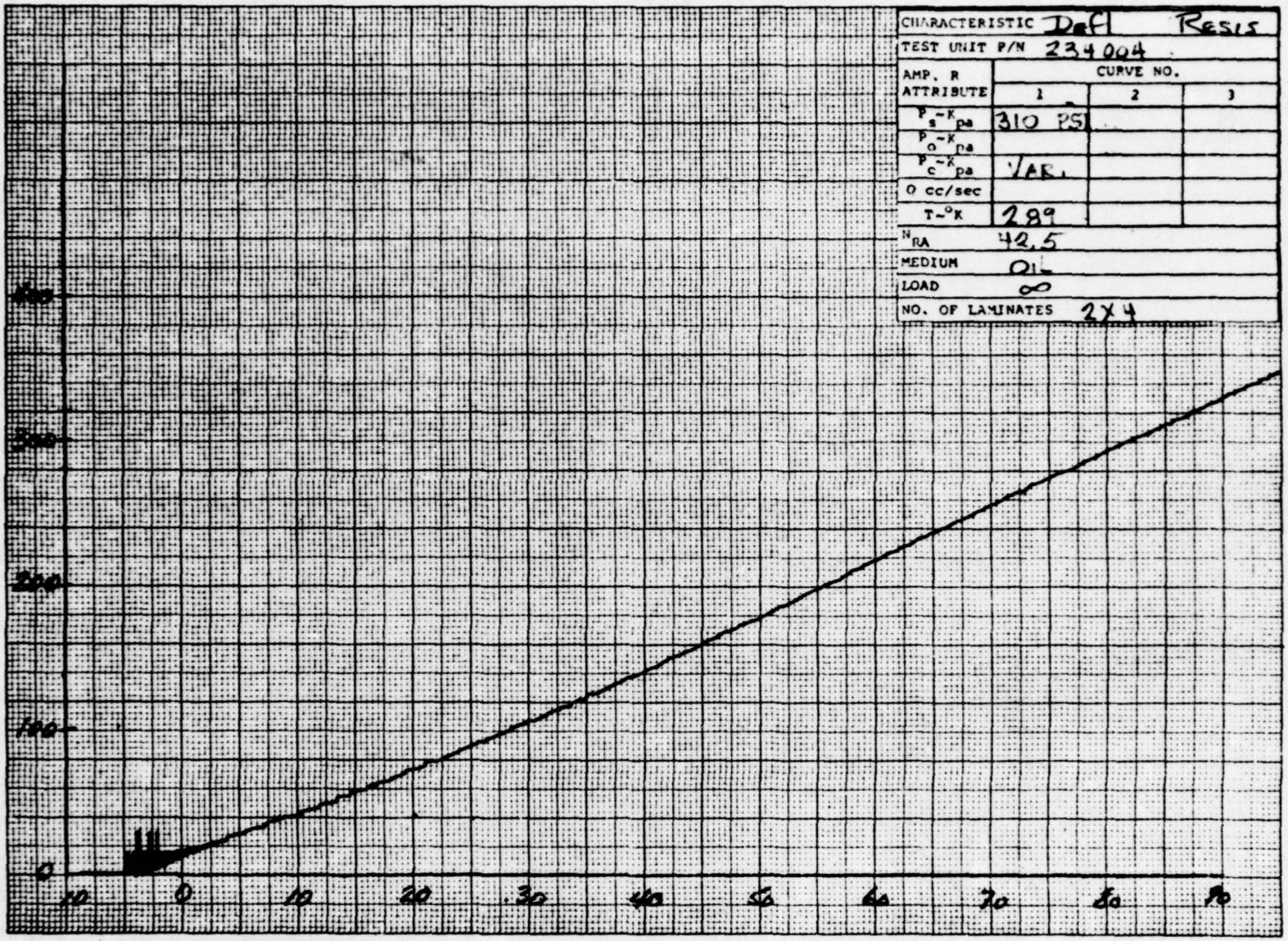
526


CHARACTERISTIC Def. Resis
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa 200 PSI
$P_o$~K pa
$P_{cr}$~K pa VAR
Q cc/sec
T~°K 330
$N_{RA}$ 85
MEDIUM OIL
LOAD ∞
NO. OF LAMINATES 2 x 6
0 5 10 15 20 25 30 35
ΔPc, psi

527


CHARACTERISTIC Def. Resis
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~ K pa 200 PSI
$P_o$ ~ K pa
$P_c$ ~ K pa VAR
O cc/sec
T ~ °K 330
$N_{RA}$ 85
MEDIUM 01
LOAD ∞
NO. OF LAMINATES 2x6
400
300
200
100
0
5
10
15
20
25
30
35
$\Delta P_c$ , psi

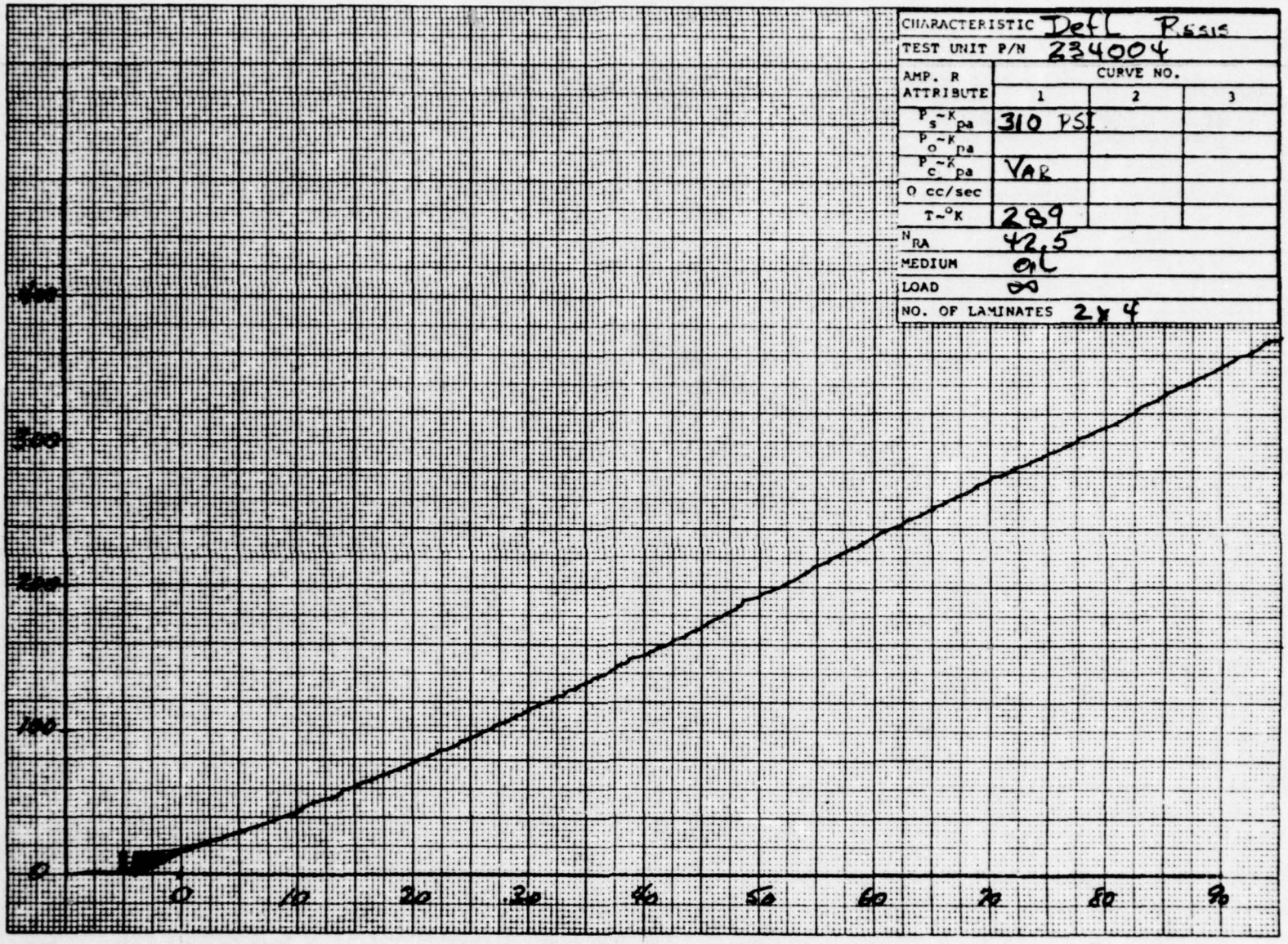
528



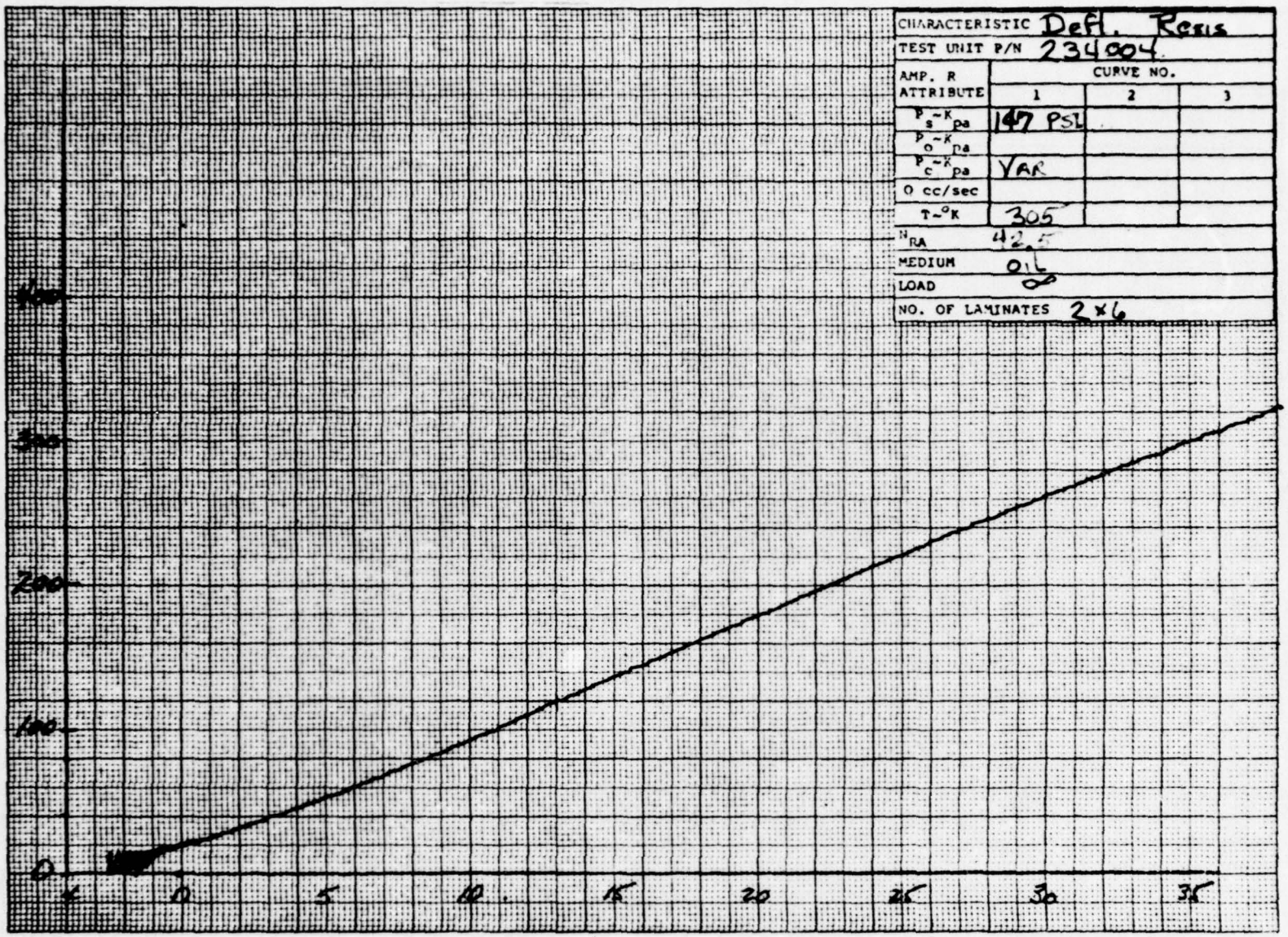

529

$Q_c$, Hz

$\Delta P_c$, psi


CHARACTERISTIC Def. Press
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa 310 PSI
$P_o$~K pa
$P_c$~K pa VAR
0 cc/sec
T~°K 289
$N_{RA}$ 42.5
MEDIUM air
LOAD ∞
NO. OF LAMINATES 2 x 4
0
40
60
80
100
0
10
20
30
40
50
60
70
80
90
$\Delta P_c$, psi

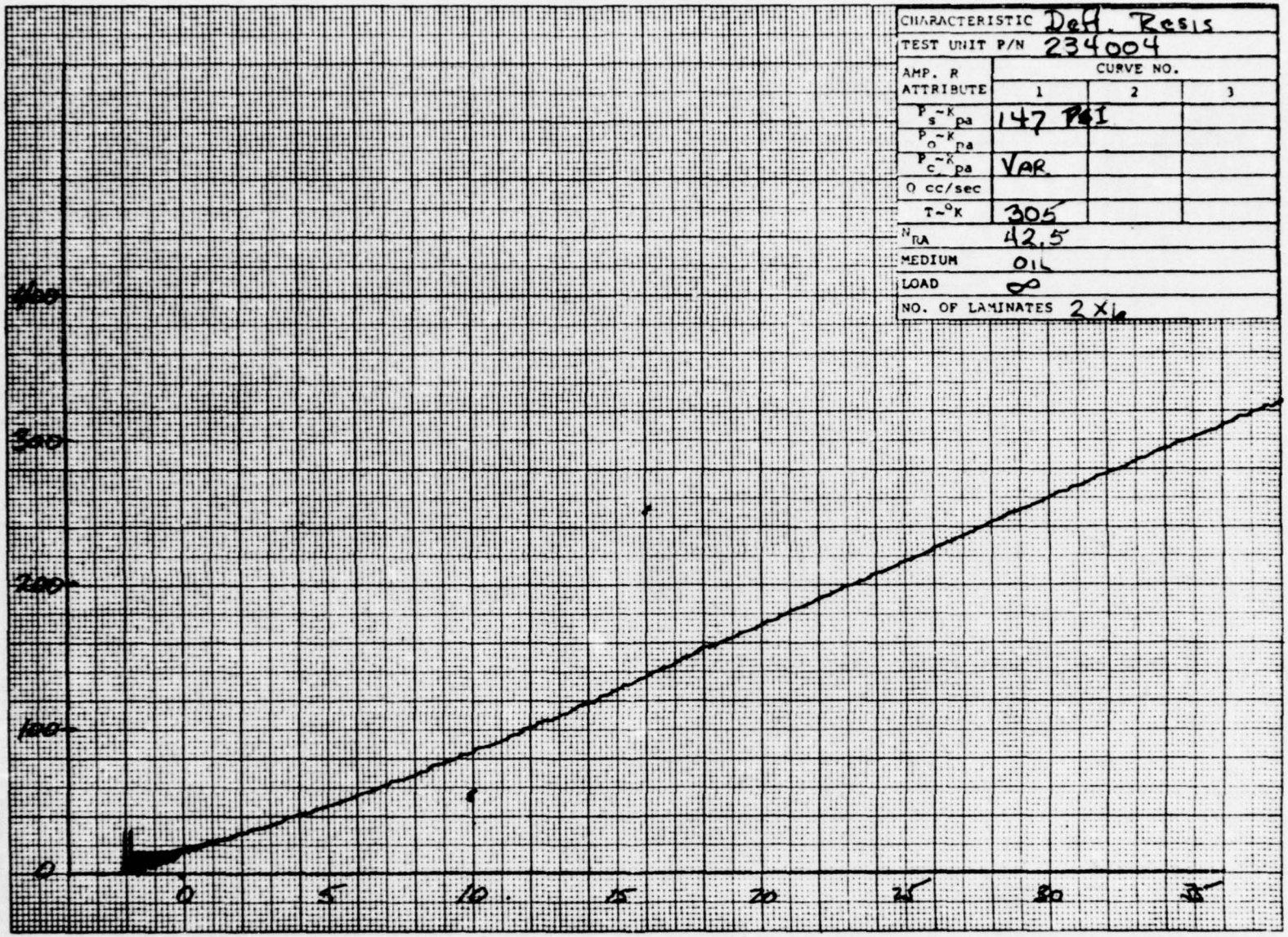
530


CHARACTERISTIC Defl. Resis
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$-Kpa 147 PSI
$P_o$-Kpa
$P_c$-Kpa YAR
0 cc/sec
T-°K 305
$N_{RA}$ 42.5
MEDIUM OIL
LOAD 8
NO. OF LAMINATES 2x6
400
300
200
100
0
0
5
10
15
20
25
30
35
ΔPc, psi

531

Pc - Hg

| CHARACTERISTIC | Def. Resis | | |
|---|---|---|---|
| TEST UNIT P/N | 234004 | | |
| AMP. R ATTRIBUTE | CURVE NO. 1 | 2 | 3 |
| $P_s$ ~ K pa | 147 PSI | | |
| $P_o$ ~ K pa | | | |
| $P_c$ ~ K pa | VAR. | | |
| 0 cc/sec | | | |
| T ~ °K | 305 | | |
| $N_{RA}$ | 42.5 | | |
| MEDIUM | OIL | | |
| LOAD | ∞ | | |
| NO. OF LAMINATES | 2 X 16 | | |

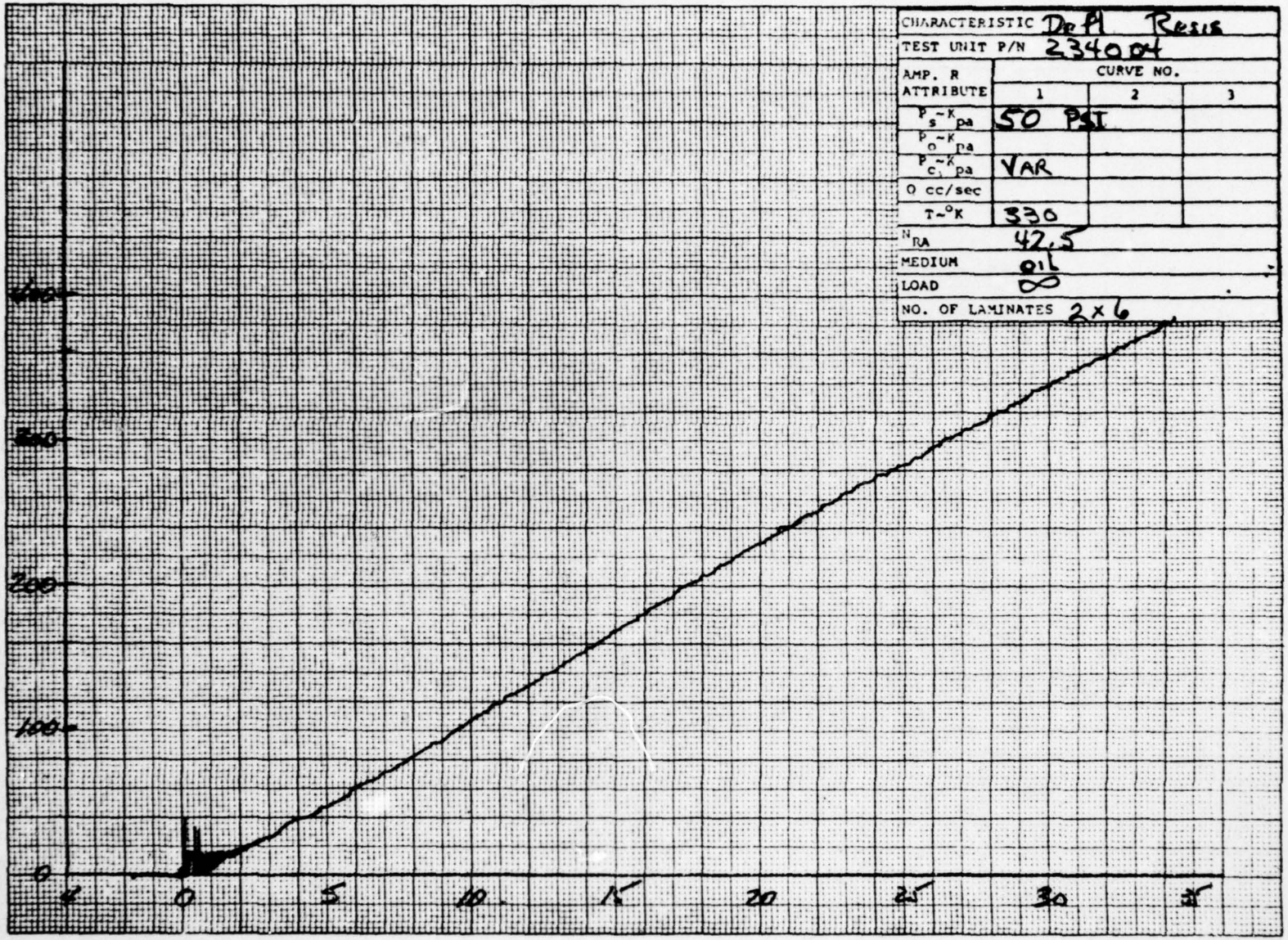



$Q_{c2}$, lb/sec

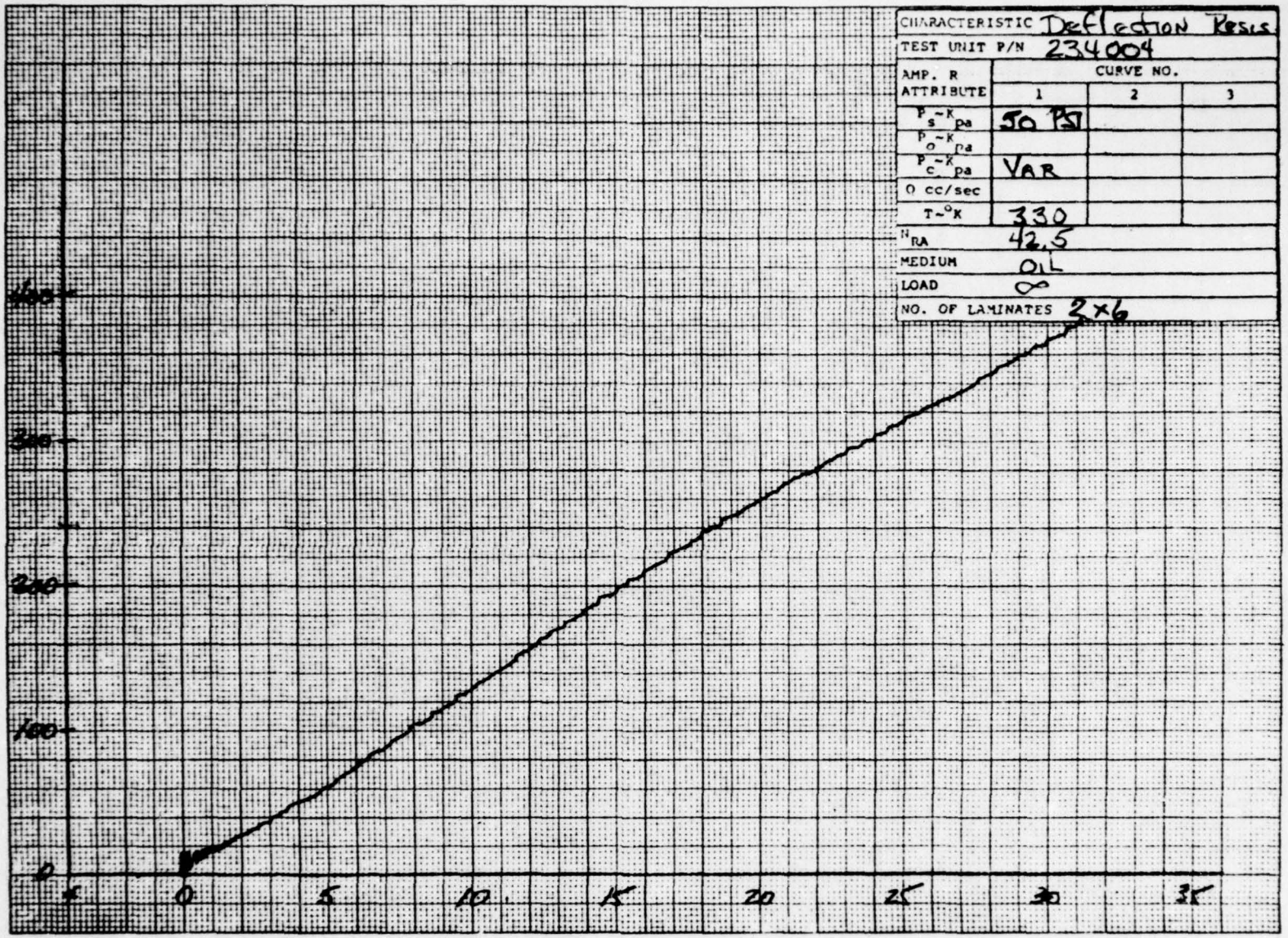
532

$\Delta P_c$, psi

CLEARPRINT PAPER CO. NO. C35 MILLIMETERS BOTH WAYS 100 X 250 DIVISIONS
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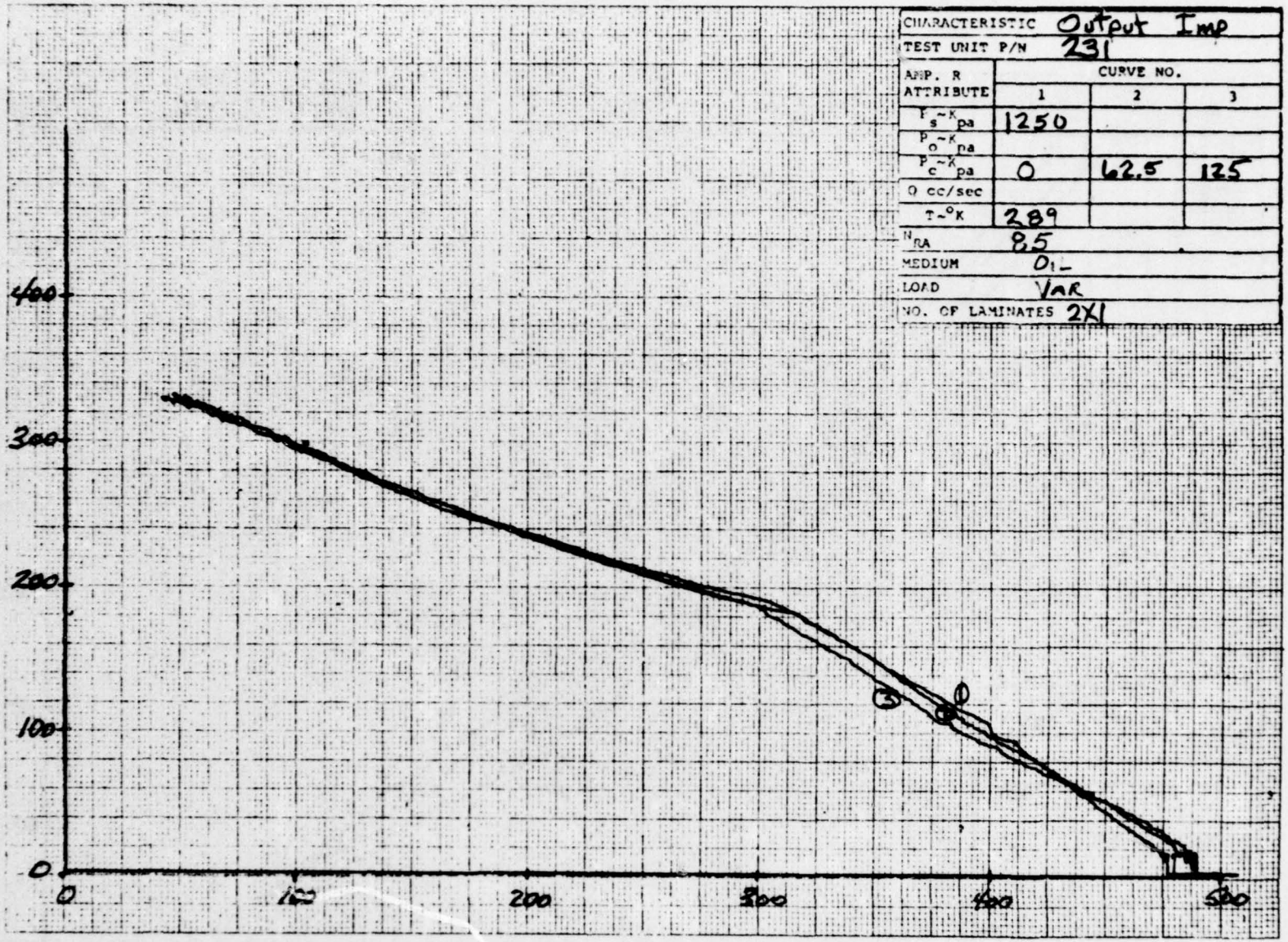

CHARACTERISTIC Dp Pi Resis
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa 50 PSI
$P_o$~K pa
$P_{c_1}$ pa VAR
Q cc/sec
T~°K 330
$N_{RA}$ 42.5
MEDIUM oil
LOAD ∞
NO. OF LAMINATES 2 x 6
400
300
200
100
0
0
5
10
15
20
25
30
35
$R_i$, Hz
$\Delta P_c$ psi

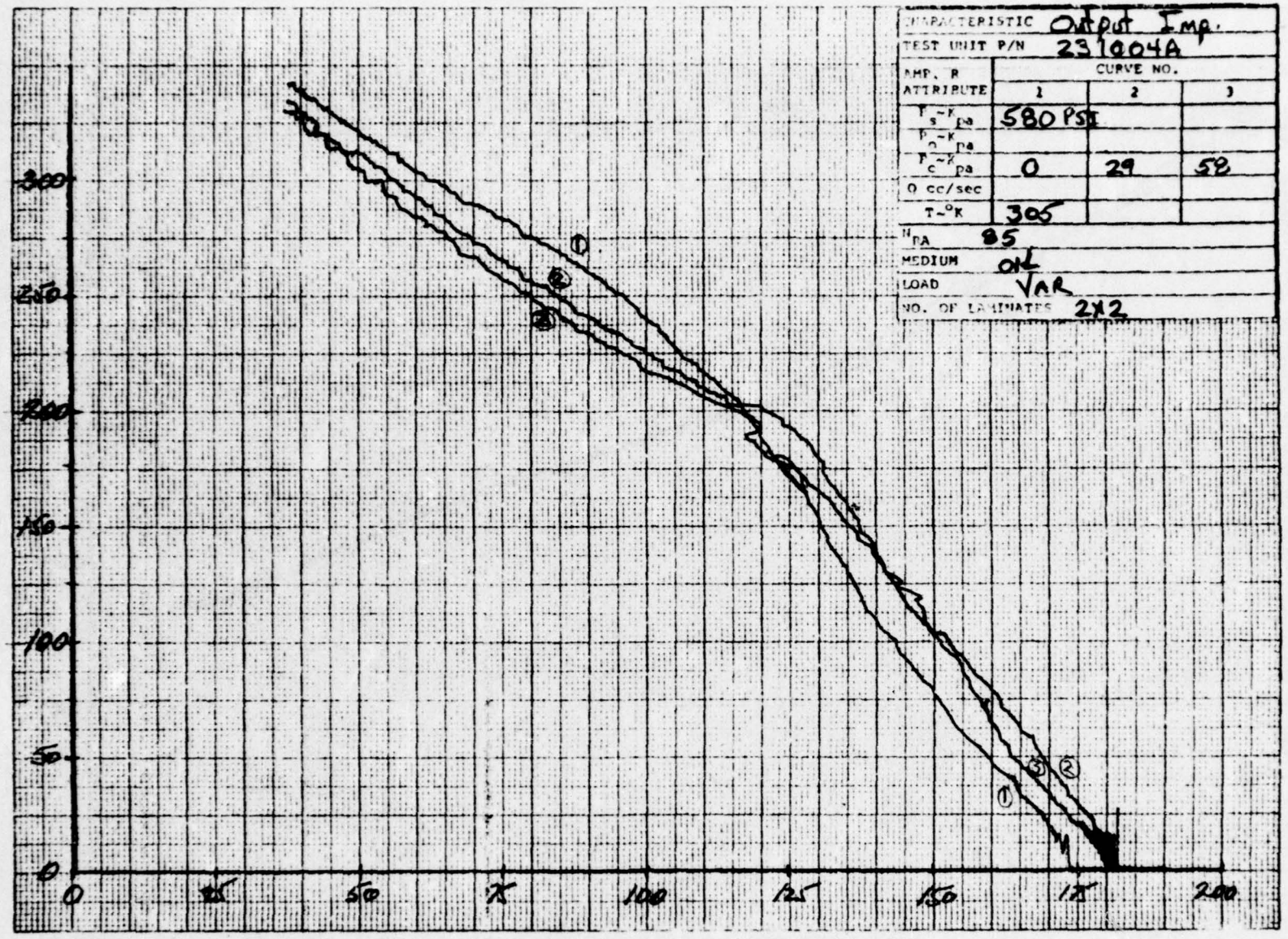
533


CHARACTERISTIC Deflection Resis
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~K pa
50 PSI
$P_o$ ~K pa
$P_c$ ~K pa
VAR
Q cc/sec
T ~°K
330
$N_{RA}$
42.5
MEDIUM
OIL
LOAD
∞
NO. OF LAMINATES
2x6
400
300
200
100
0
0
5
10
15
20
25
30
35
$\Delta P_c$, psi

534

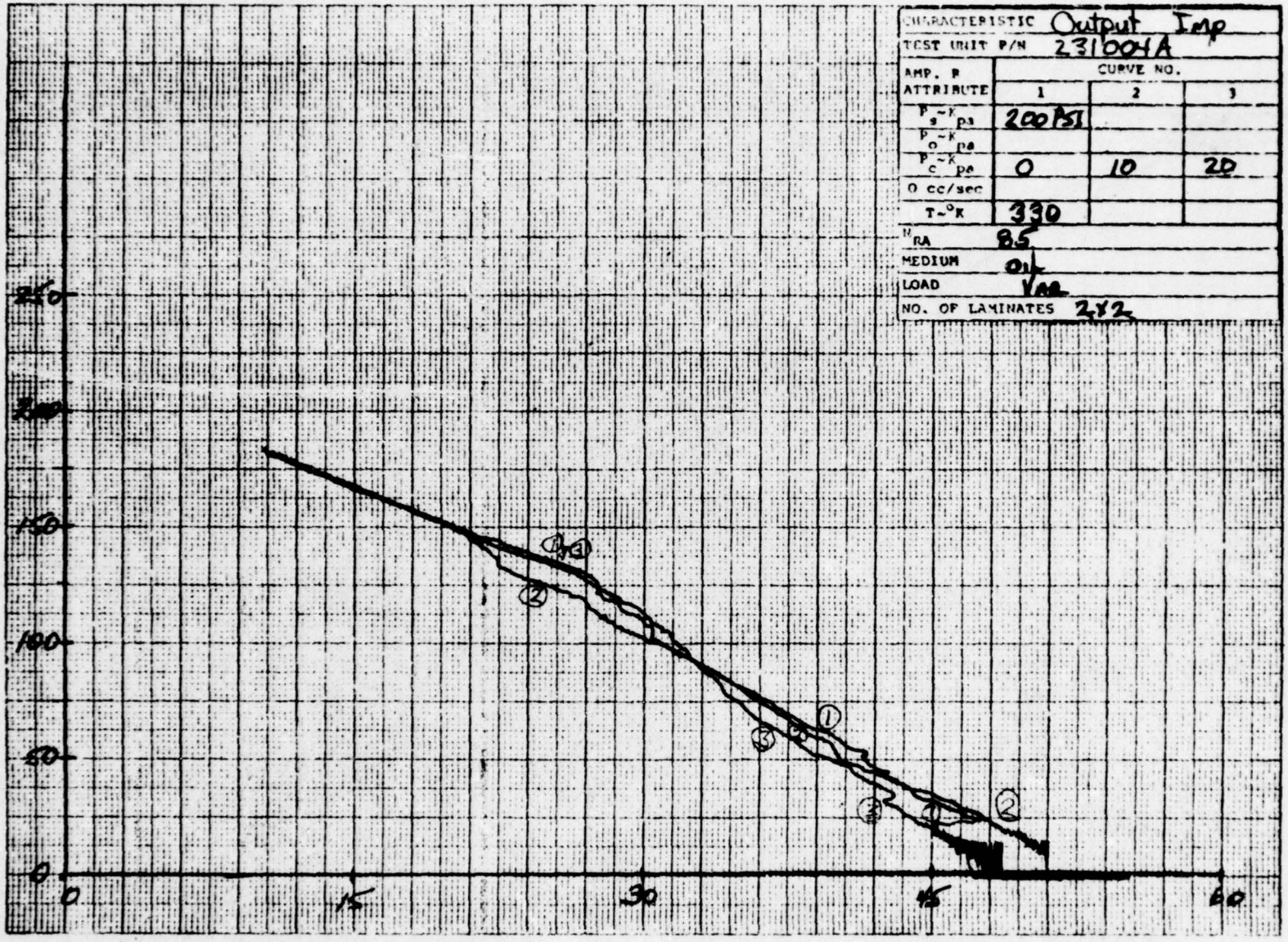
$Q_c$, cc

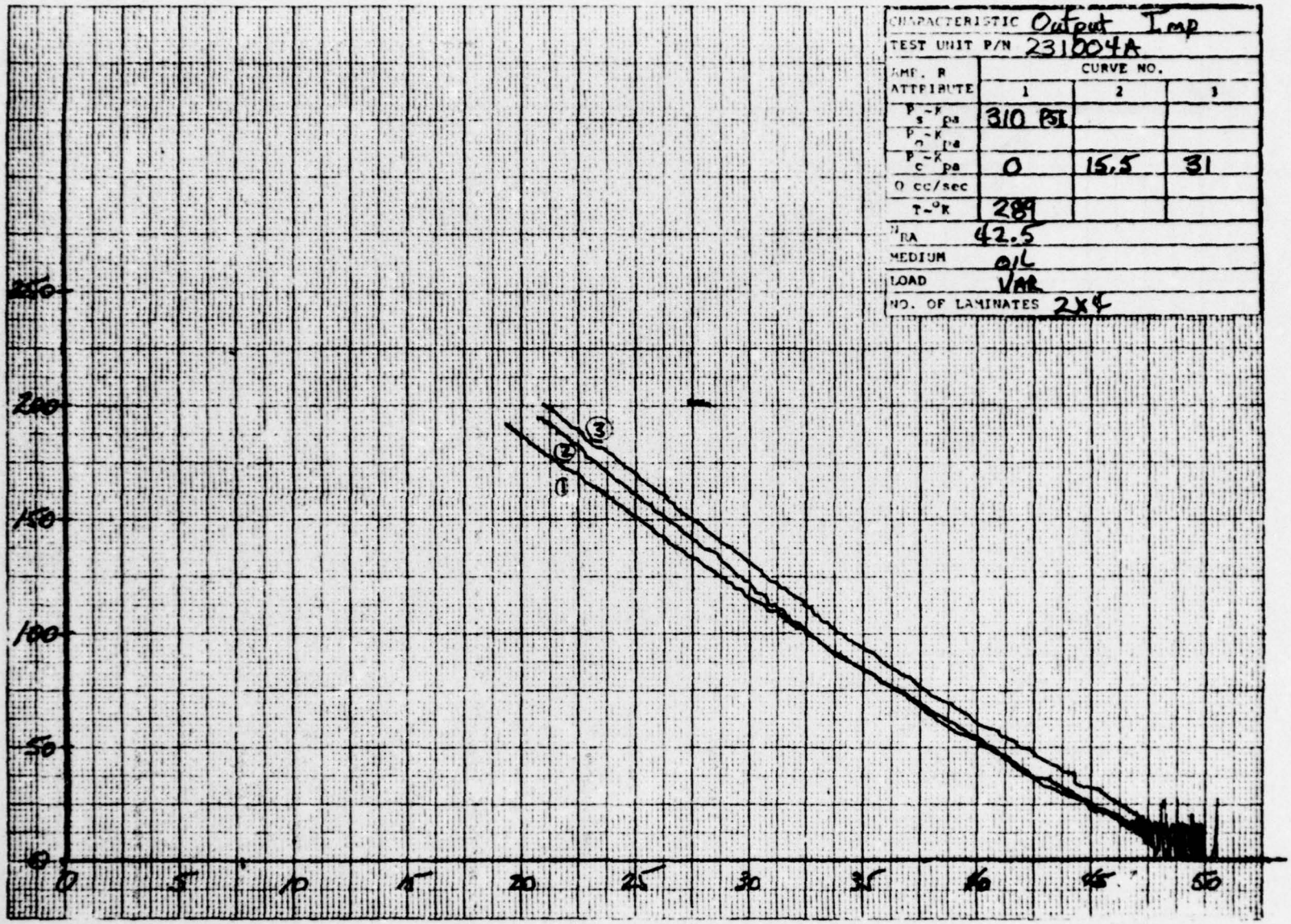

CHARACTERISTIC Output Imp
TEST UNIT P/N 231
APP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~K pa 1250
$P_o$ ~K pa
$P_c$ ~K pa 0 62.5 125
Q cc/sec
T ~°K 289
$N_{DA}$ 8.5
MEDIUM Oil
LOAD VAR
NO. OF LAMINATES 2X1
400
300
200
100
0
0
100
200
300
400
500
$Q_o$, $H_3$
$P_o$, psi
535


CHARACTERISTIC Output Imp.
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
580 PSI
$P_a$~K pa
$P_c$~K pa
0
29
58
Q cc/sec
T~°K
306
$N_{PA}$ 85
MEDIUM OIL
LOAD VAR
NO. OF LAMINATES 2X2
300
250
200
150
100
50
0
0
25
50
75
100
125
150
175
200
Po, psi

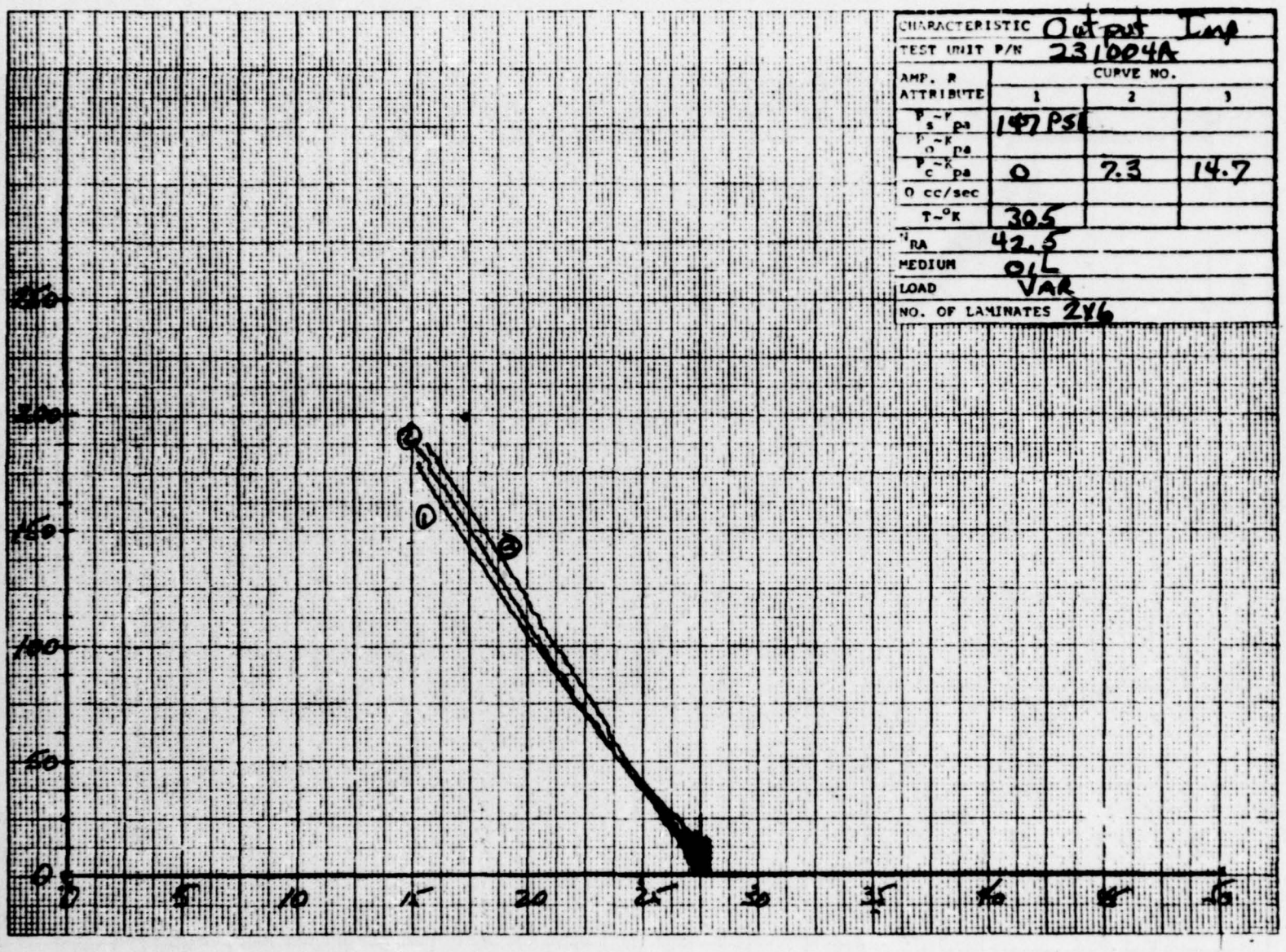
536

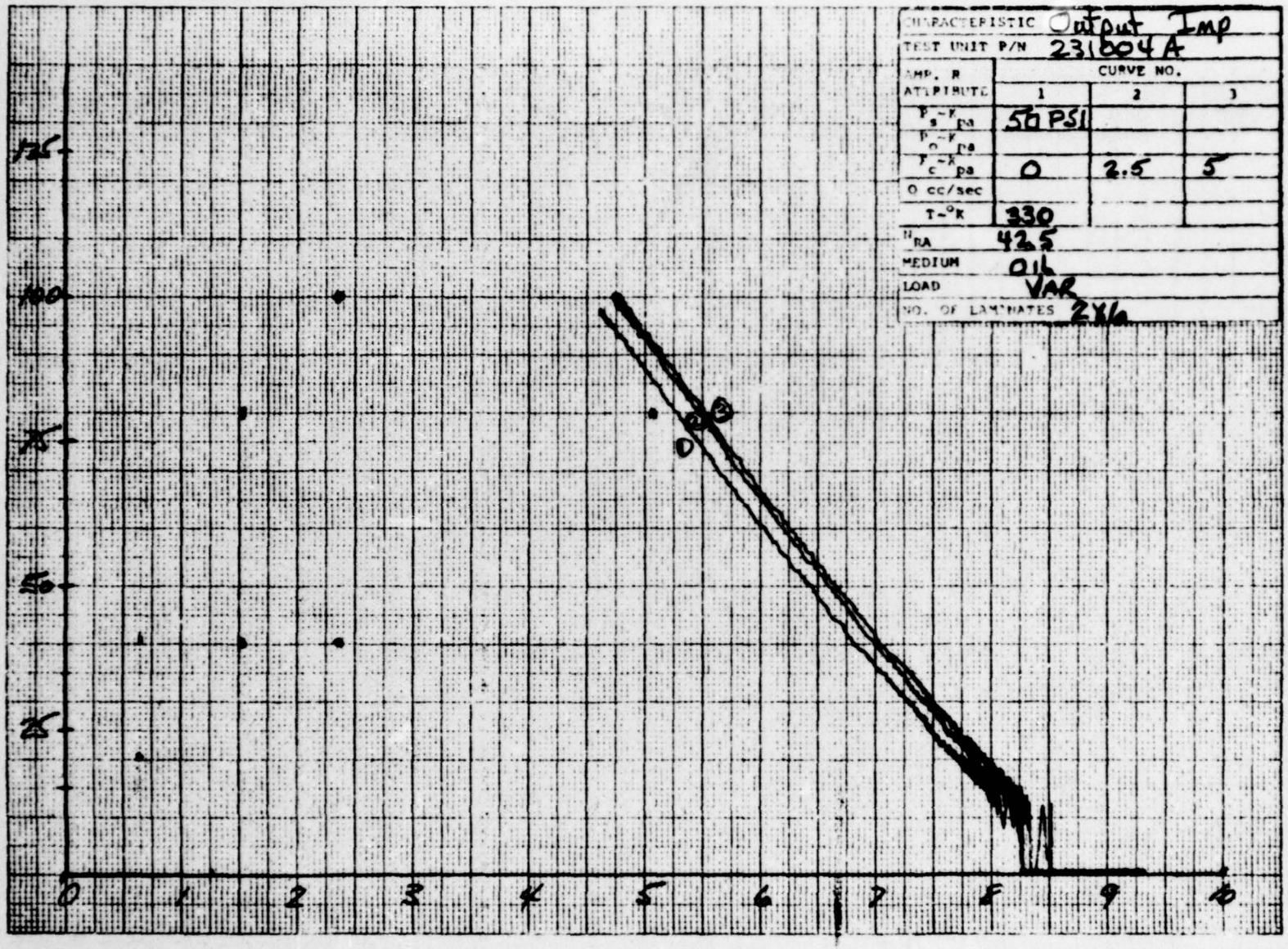
Eq. 9a

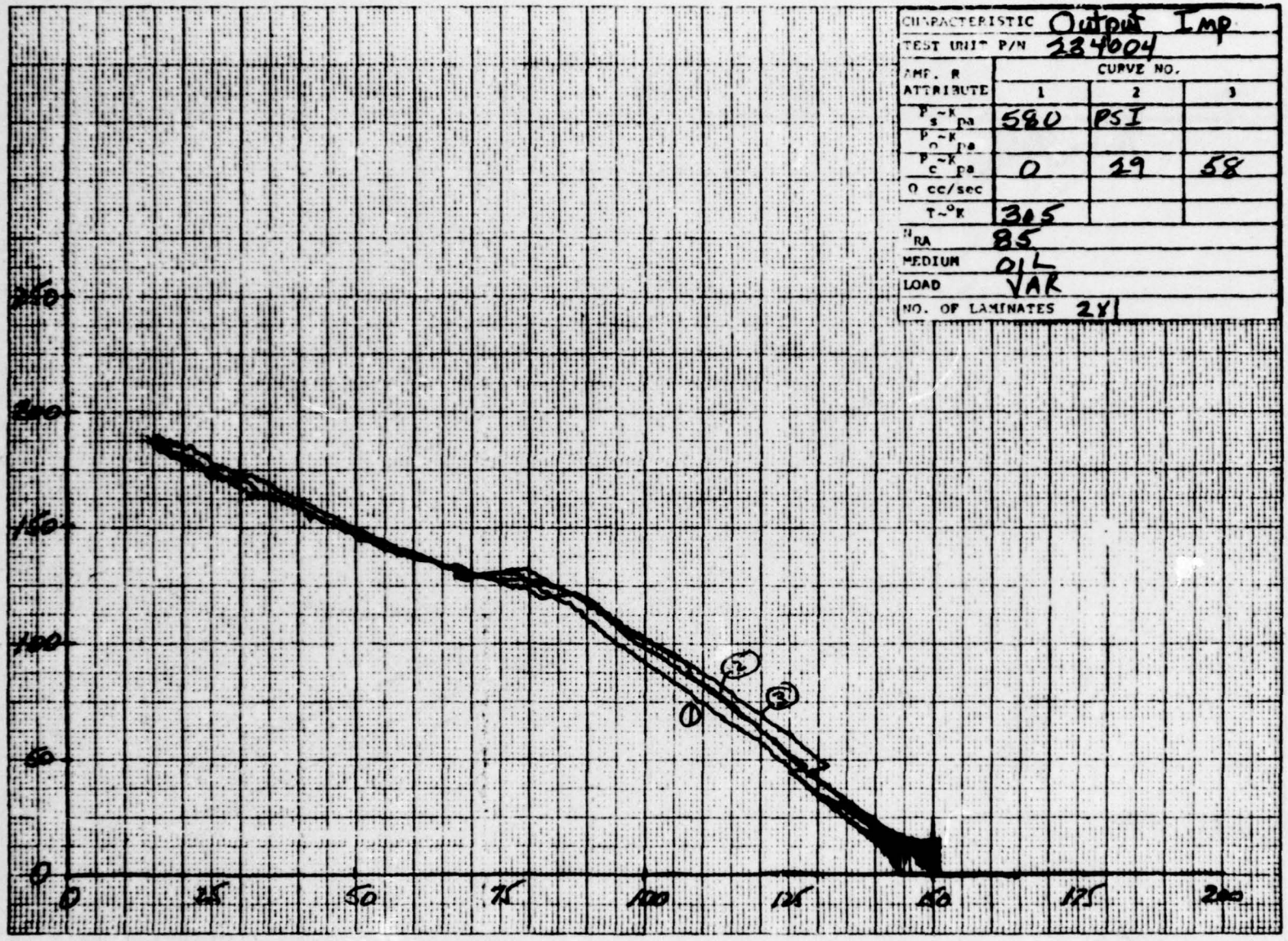

CHARACTERISTIC Output Imp
TEST UNIT P/N 231004A
AMP. P ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K psi
200 PSI
$P_o$~K psi
$P_c$~K psi
0
10
20
Q cc/sec
T~°K
330
$N_{RA}$
8.5
MEDIUM
Oil
LOAD
Res
NO. OF LAMINATES
282
250
200
150
100
50
0
0
15
30
45
60
$P_o$, psi
$Q_o$, lpm
537

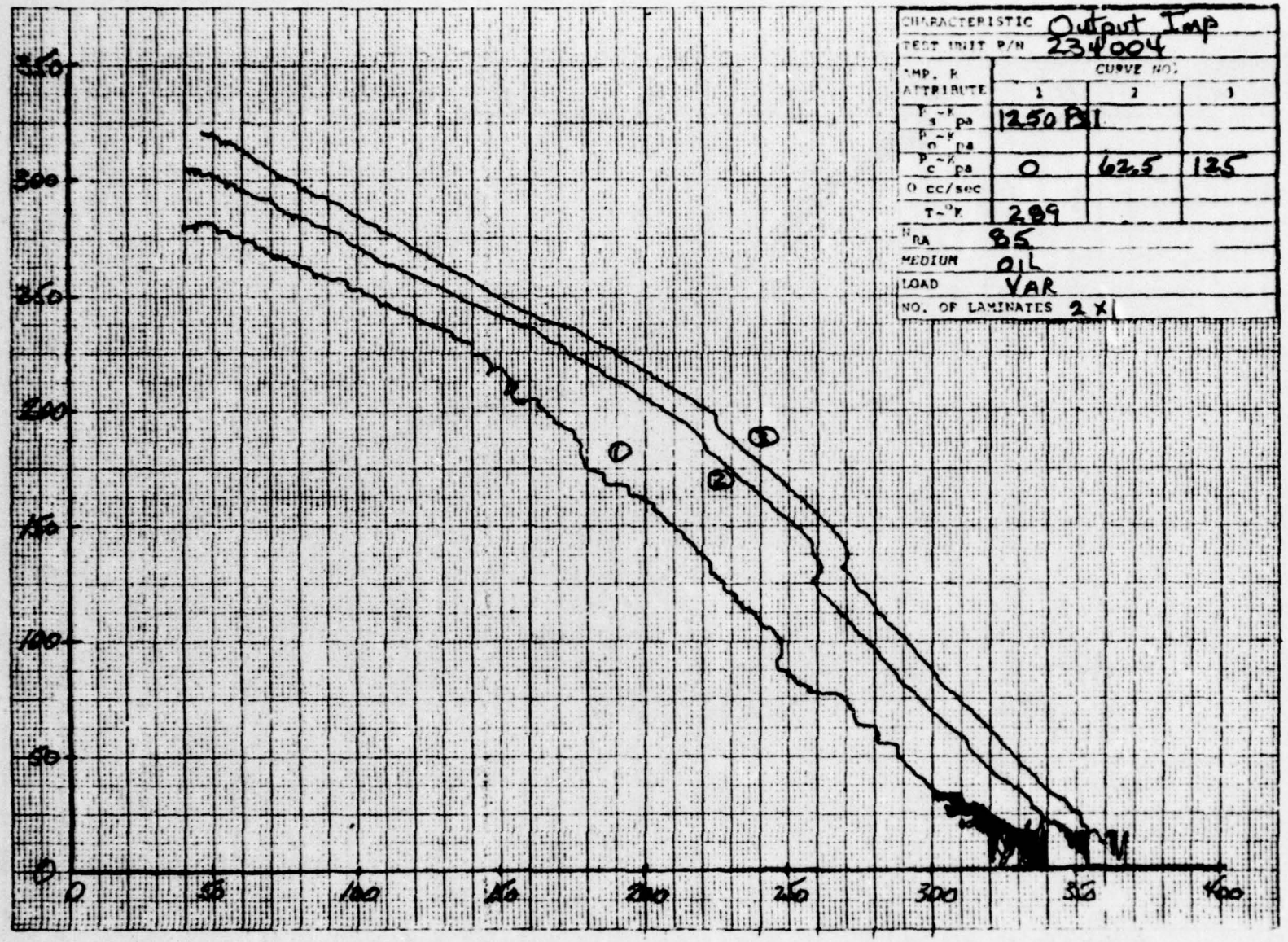

CHARACTERISTIC Output Imp
TEST UNIT P/N 231004A
AMB. P ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~ psi
310 PSI
$P_a$ ~ psi
$P_c$ ~ psi
0
15.5
31
Q cc/sec
T ~ °R
289
$P_{BA}$
42.5
MEDIUM
OIL
LOAD
VAR
NO. OF LAMINATES
2X4
250
200
150
100
50
0
0
5
10
15
20
25
30
35
40
45
50
1
2
3
Qo, #3
Po, psi

538

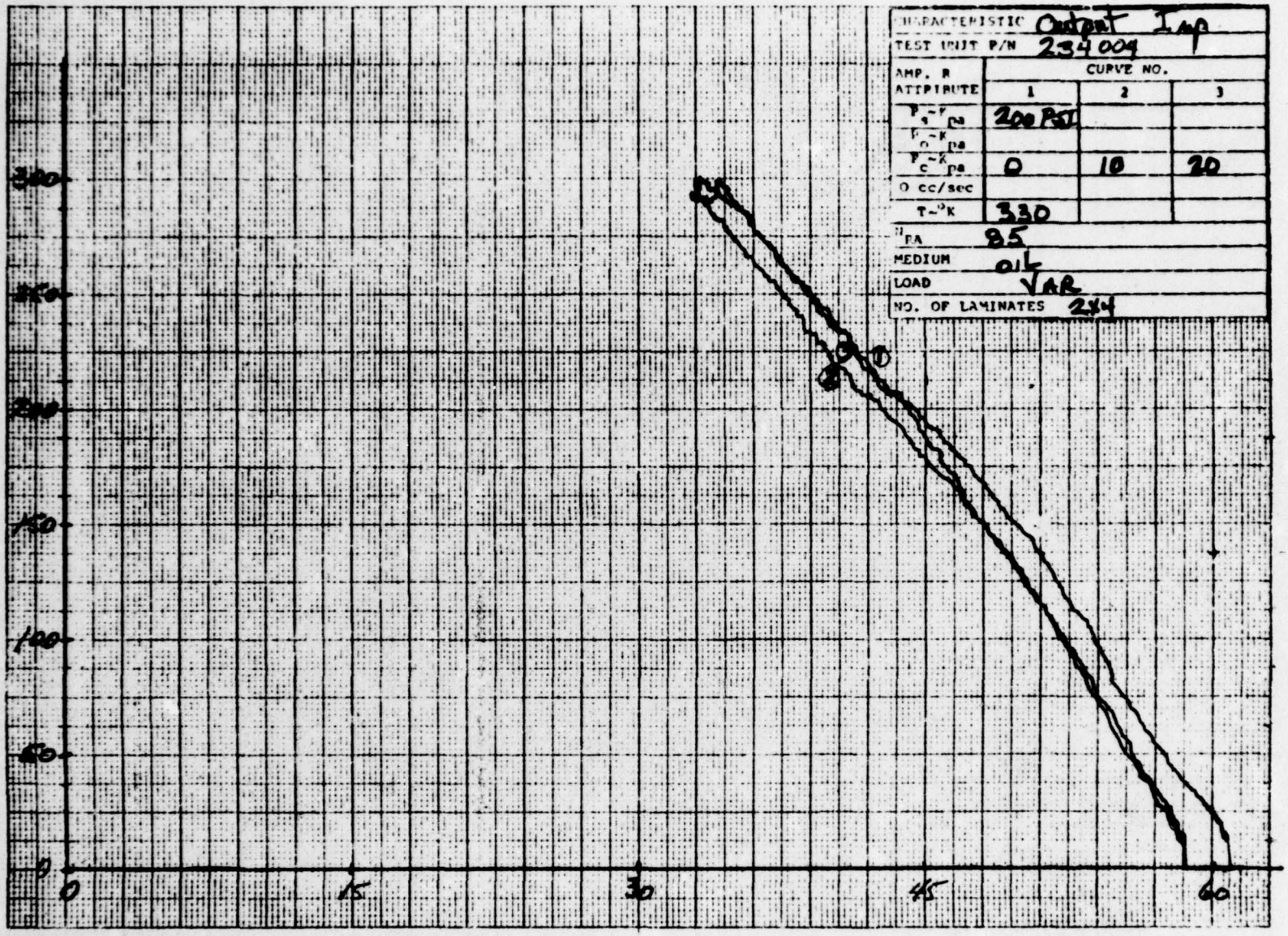

CHARACTERISTIC Output Imp
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Pa 147 PSI
$P_o$~Pa
$P_c$~Pa 0 7.3 14.7
0 cc/sec
T~°K 305
RA 42.5
MEDIUM OIL
LOAD VAR
NO. OF LAMINATES 246
250
200
150
100
50
0
0
5
10
15
20
25
30
35
40
45
50
539
$P_i$, Psi
Po, psi

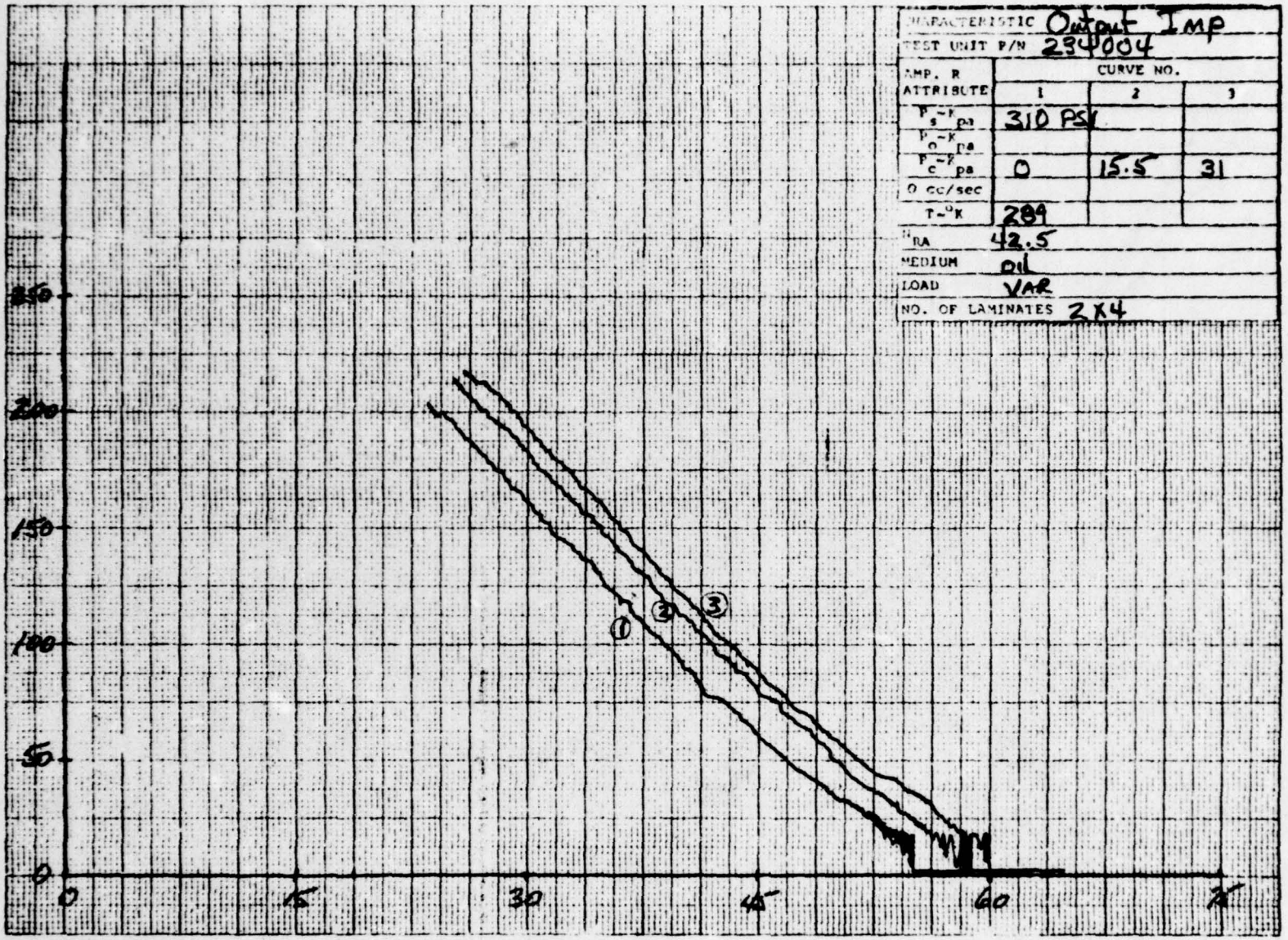

CHARACTERISTIC Output Imp
TEST UNIT P/N 231004A
IMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s - P_{ps}$
50 PSI
$P_o - P_{ps}$
$P_c - P_{ps}$
0
2.5
5
Q cc/sec
T-°K
330
$N_{RA}$
425
MEDIUM
Oil
LOAD
VAR
NO. OF LAMINATES
2X6
125
100
75
50
25
0
1
2
3
4
5
6
7
8
9
10
Qo, Hz
540
Po, PSI


CHARACTERISTIC Output Imp
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~K Pa
580
PSI
$P_o$ ~K Pa
$P_c$ ~K Pa
0
29
58
Q cc/sec
T ~°K
305
$\eta_{RA}$
85
MEDIUM
OIL
LOAD
VAR
NO. OF LAMINATES
24
250
200
150
100
50
0
0
25
50
75
100
125
150
175
200
1
2
3
Qo, Hz
Po, psi

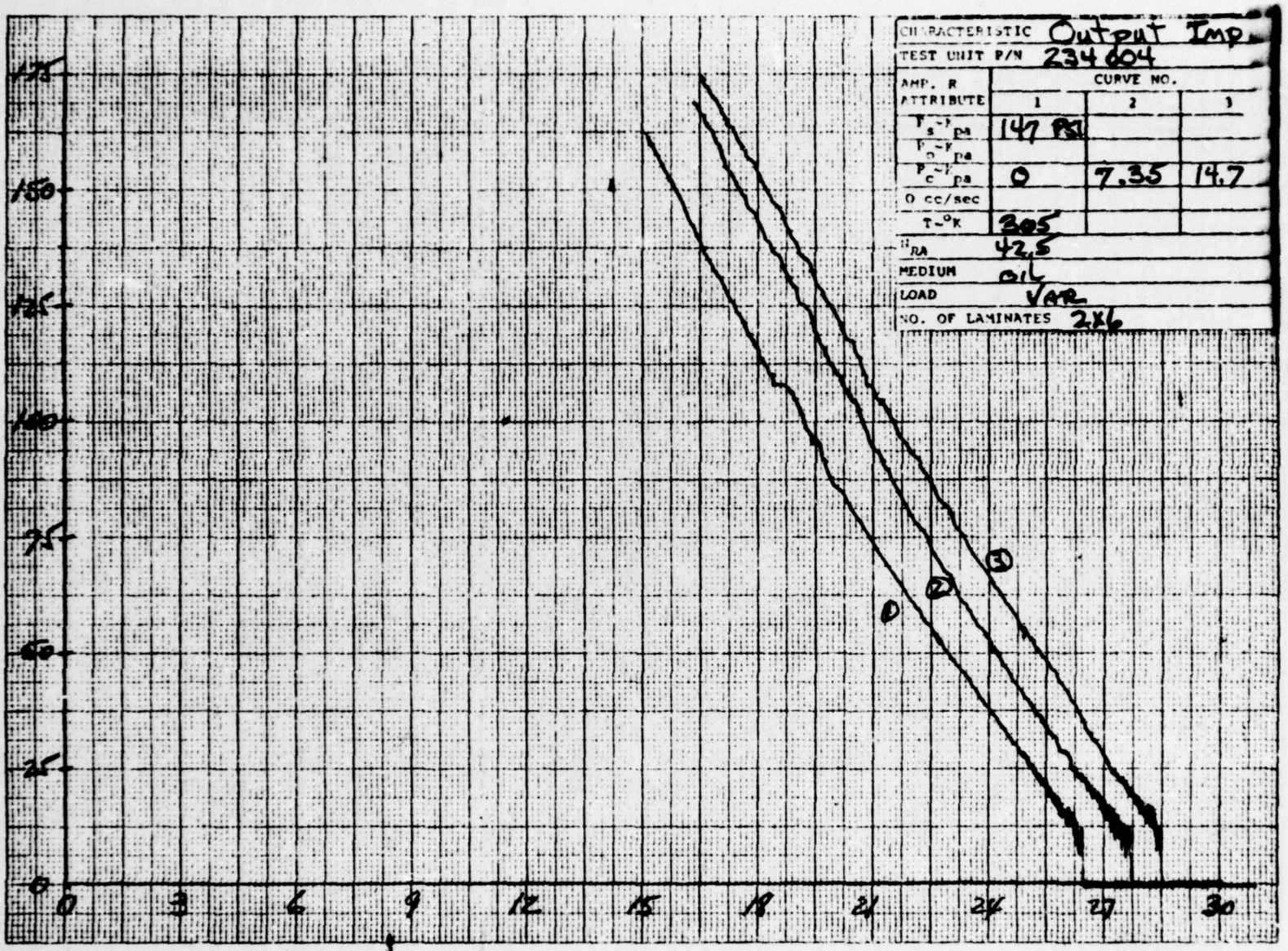

CHARACTERISTIC Output Imp
TEST UNIT P/N 234004
CURVE NO.
1
2
3
$P_s$ psi 1250 PSI
$P_o$ psi
$P_c$ psi 0 62.5 125
Q cc/sec
T °F 289
RA 85
MEDIUM OIL
LOAD VAR
NO. OF LAMINATES 2 X
250
200
150
100
50
0
0
50
100
150
200
250
300
350
400
Po, psi

542

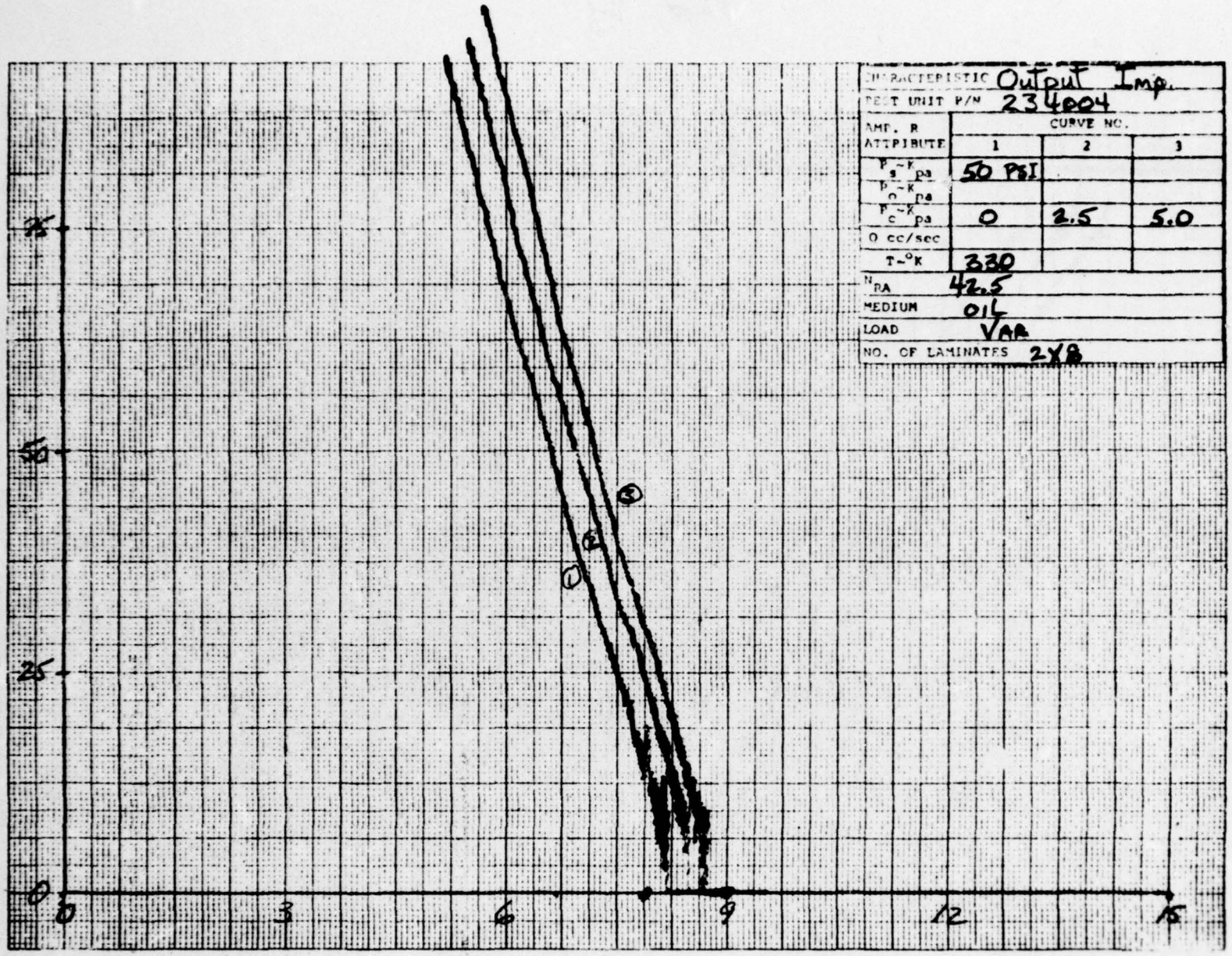

CHARACTERISTIC Output Imp
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
200 PSI
0
10
20
330
85
oil
VAR
NO. OF LAMINATES 284
300
250
200
150
100
50
0
0
15
30
45
60
Qo, lbs
Po, psi

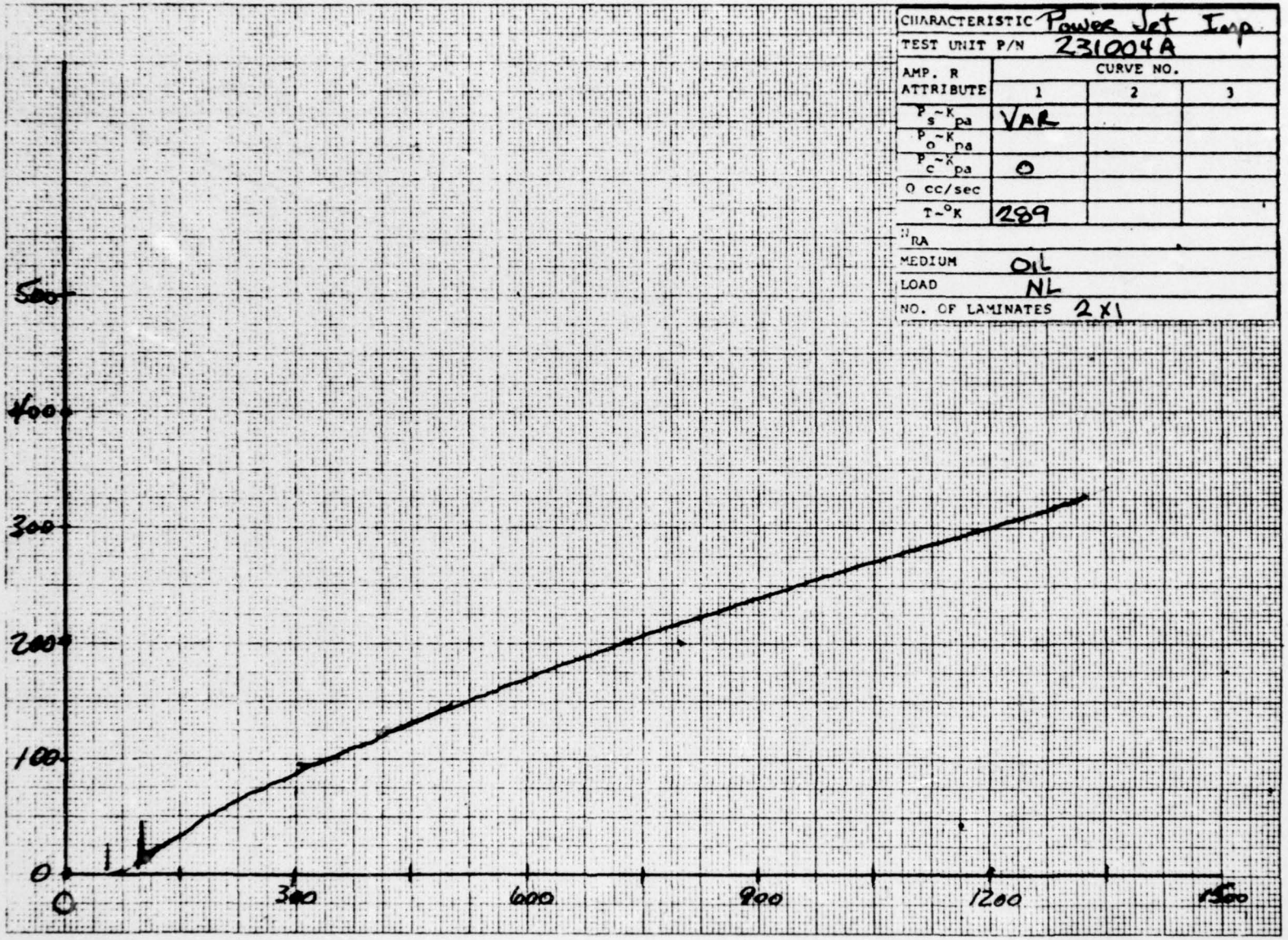

CHARACTERISTIC Output Imp
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s - K_{pa}$
310 PSI
$P_o - K_{pa}$
$P_c - K_{pa}$
0
15.5
31
Q cc/sec
$T - {}^oK$
289
$R_{RA}$
42.5
MEDIUM
Oil
LOAD
VAR
NO. OF LAMINATES
2X4
Qo, lb
Po, psi
0
15
30
45
60
0
50
100
150
200
250
1
2
3

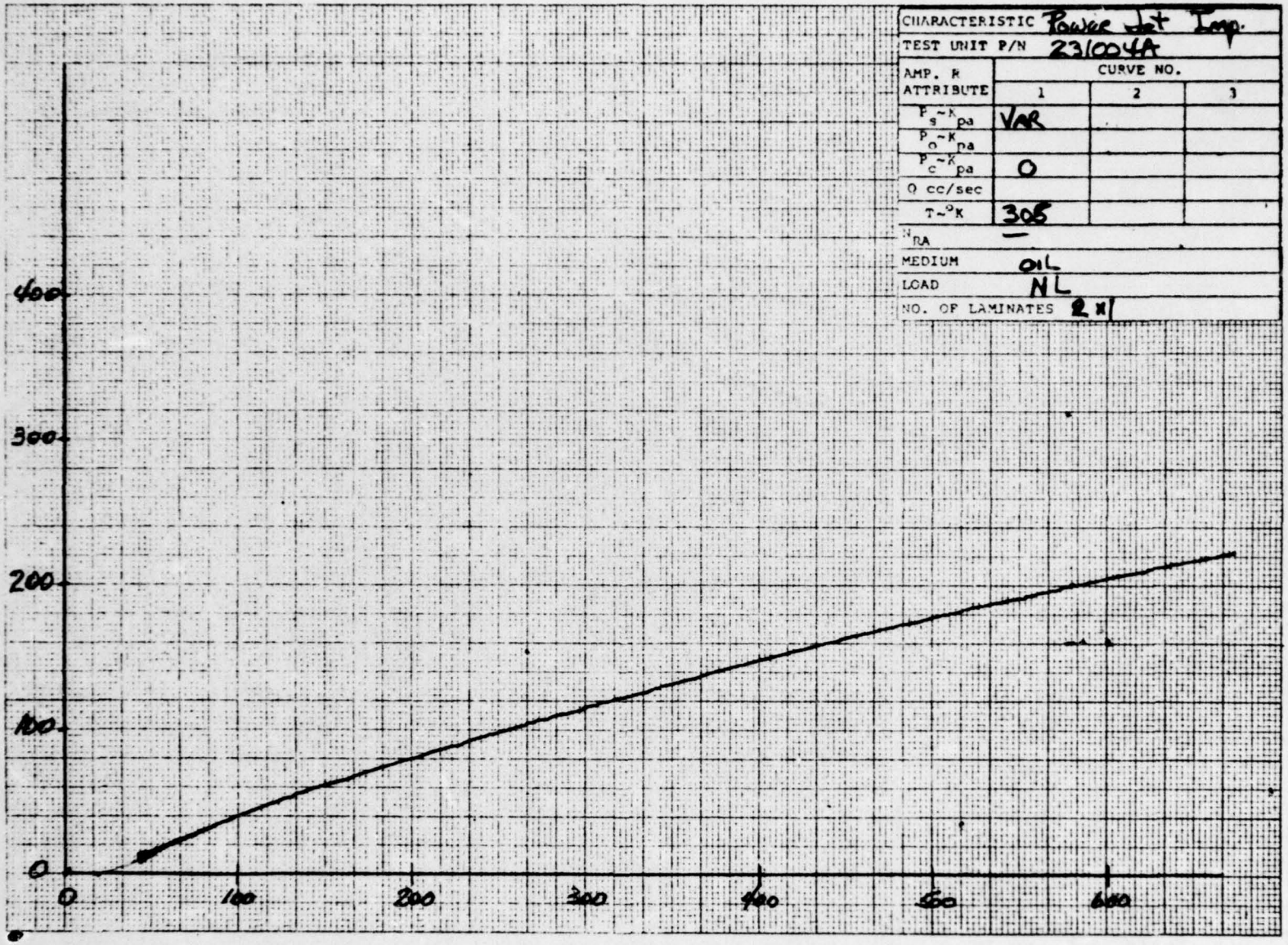
544


CHARACTERISTIC Output Imp.
TEST UNIT P/N 234604
AMP. R
ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~ psi
147 PSI
$P_b$ ~ psi
$P_c$ ~ psi
0
7.35
14.7
0 cc/sec
T ~ °K
305
$R_{RA}$
42.5
MEDIUM
oil
LOAD
VAR.
NO. OF LAMINATES
2X6
175
150
125
100
75
50
25
0
0
3
6
9
12
15
18
21
24
27
30
1
2
3
$P_o$, psi

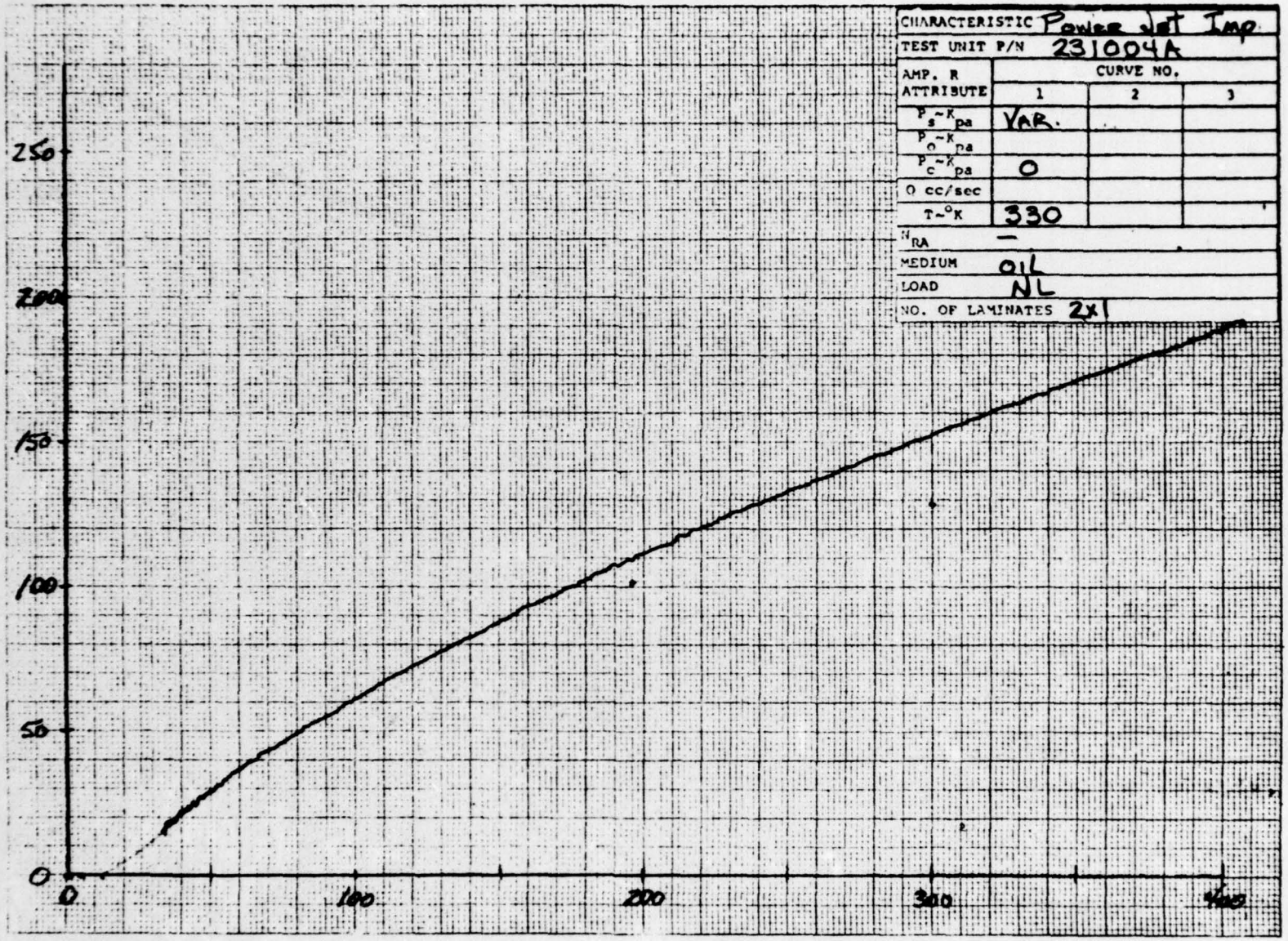
545


CHARACTERISTIC Output Imp.
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
50 PSI
$P_o$~K pa
$P_c$~K pa
0
2.5
5.0
Q cc/sec
T~°K
330
$N_{RA}$
42.5
MEDIUM
OIL
LOAD
VAR
NO. OF LAMINATES
2X8
75
50
25
0
0
3
6
9
12
15
$Q_o$, $M_s$
$P_o$, PSI
546

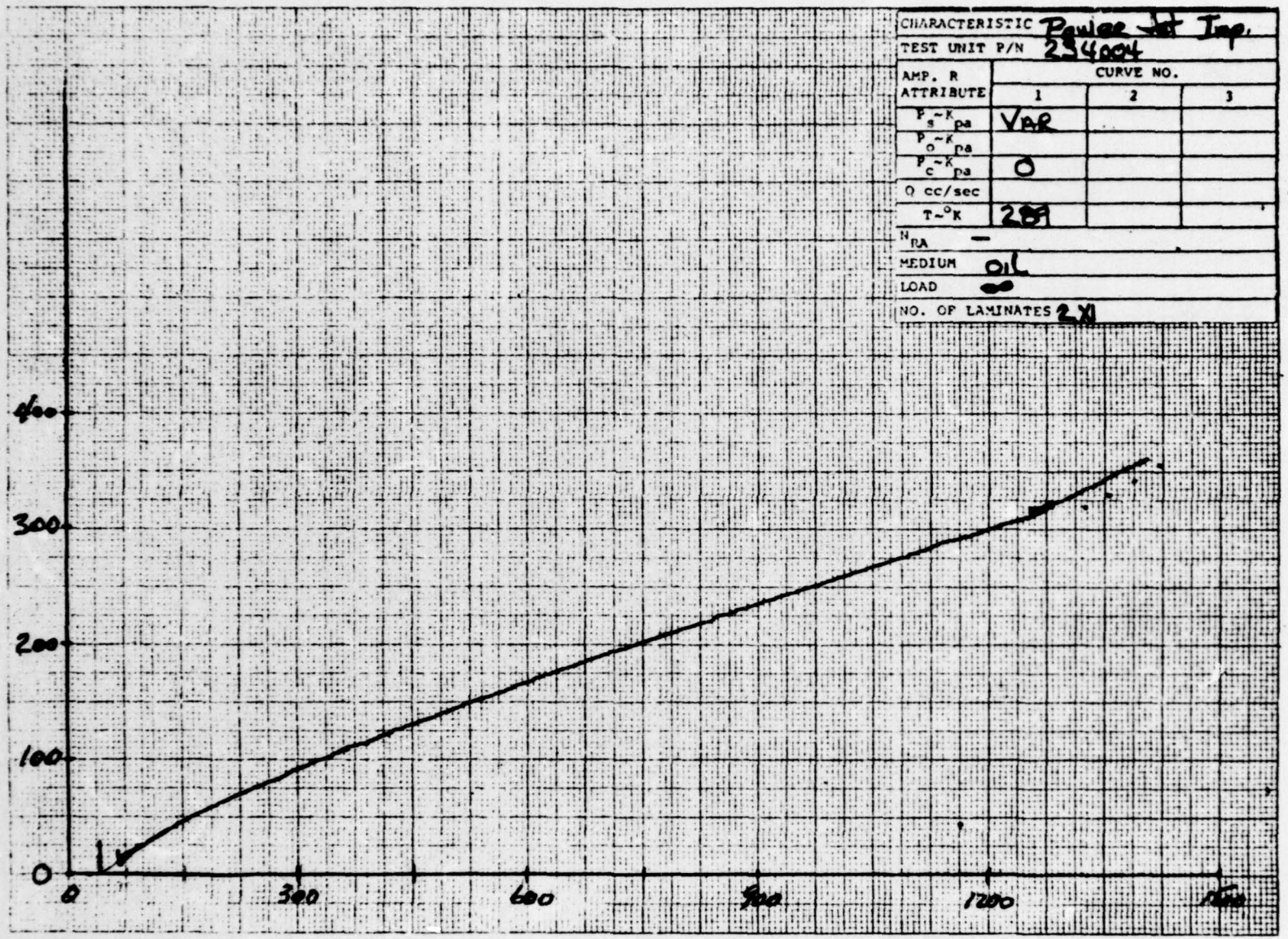

CHARACTERISTIC Power Jet Imp
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$ ~ K pa
VAR
$P_o$ ~ K pa
$P_c$ ~ K pa
0
Q cc/sec
T ~ °K
289
RA
MEDIUM
OIL
LOAD
NL
NO. OF LAMINATES
2 X 1
500
400
300
200
100
0
0
300
600
900
1200
1500
$Q_s$, in³/s
$P_s$, psi


CHARACTERISTIC Power Jet Temp.
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~Kpa VAR
$P_o$~Kpa
$P_c$~Kpa 0
Q cc/sec
T~°K 305
$N_{DA}$ —
MEDIUM OIL
LOAD NL
NO. OF LAMINATES 2 X
400
300
200
100
0
0
100
200
300
400
500
600
$P_s$, PSI

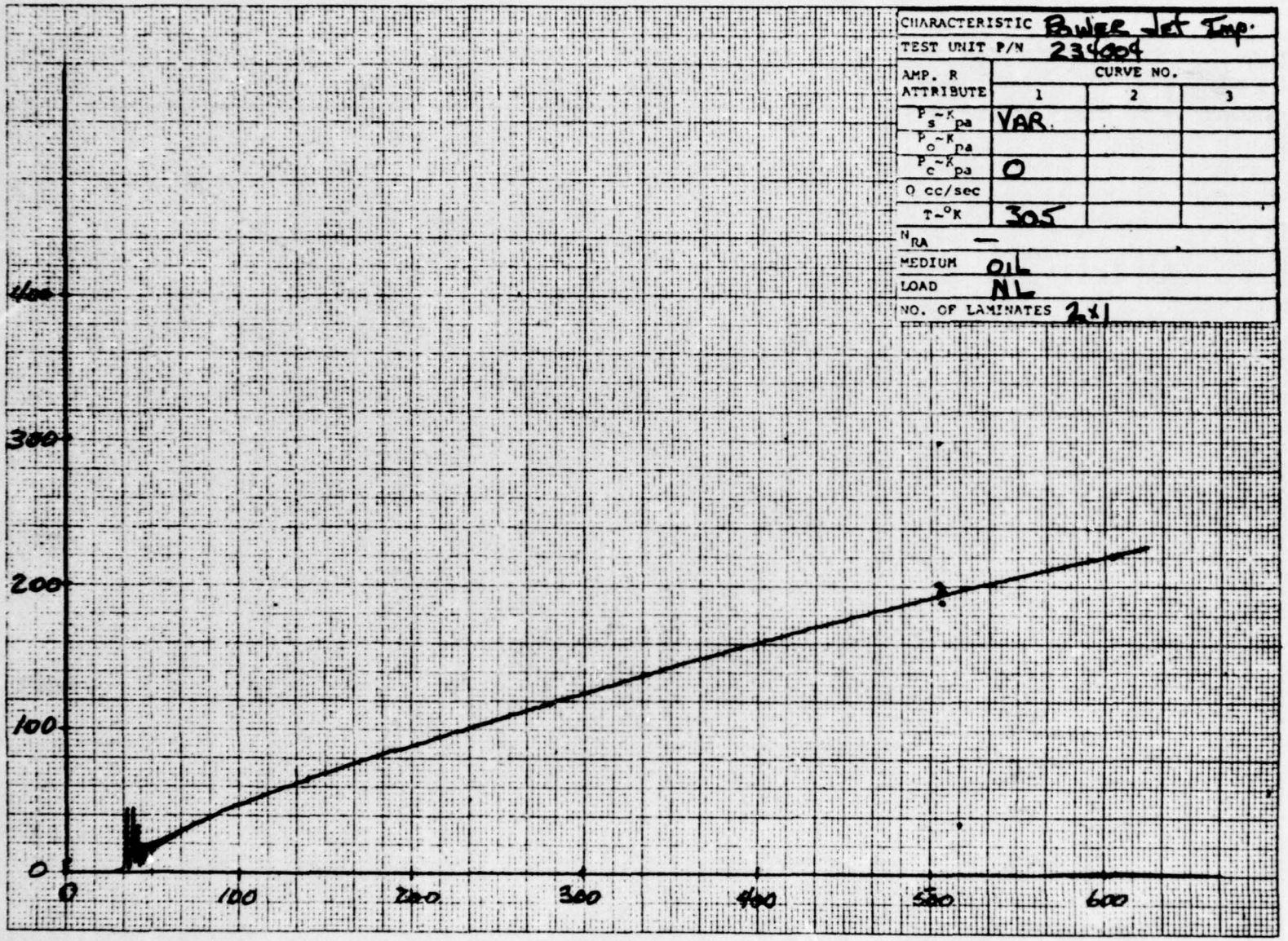
548


CHARACTERISTIC Power Jet Imp
TEST UNIT P/N 231004A
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~$K_{pa}$ VAR.
$P_o$~$K_{pa}$
$P_c$~$K_{pa}$ 0
0 cc/sec
T~°K 330
$N_{RA}$ —
MEDIUM OIL
LOAD NL
NO. OF LAMINATES 2x
250
200
150
100
50
0
0
100
200
300
$P_s$, psi

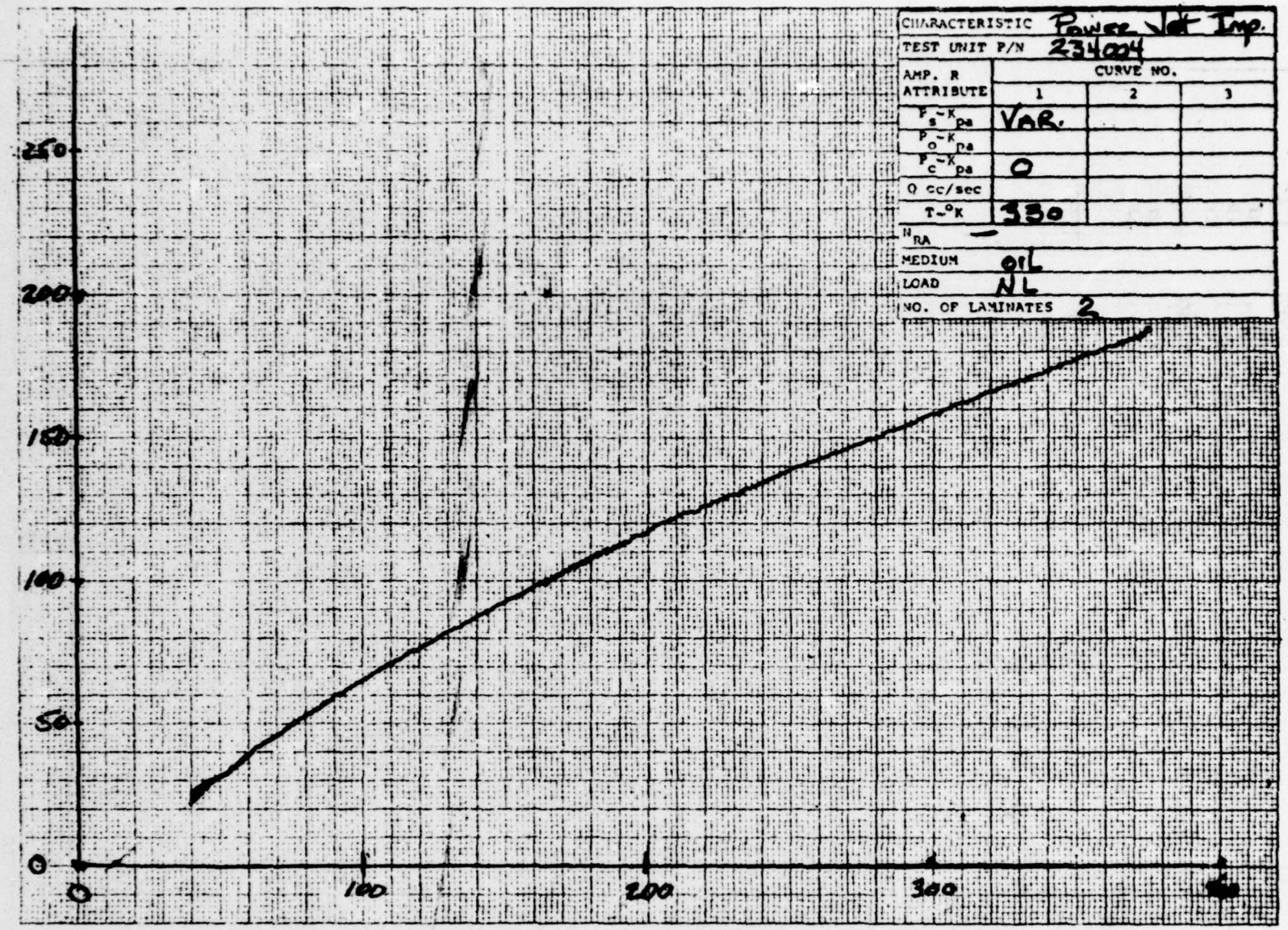
549


CHARACTERISTIC Pauses Jet Imp.
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
Var
$P_o$~K pa
$P_c$~K pa
0
Q cc/sec
T~°K
289
$N_{RA}$ —
MEDIUM Oil
LOAD ∞
NO. OF LAMINATES 2 X
400
300
200
100
0
0
300
600
900
1200
$Q_s$, $H_y$
F: psi

550


CHARACTERISTIC Power Jet Imp.
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO. 1 2 3
$P_s$~K pa VAR.
$P_o$~K pa
$P_c$~K pa 0
0 cc/sec
T~°K 305
$N_{RA}$ —
MEDIUM OIL
LOAD NL
NO. OF LAMINATES 2x1
400
300
200
100
0
0
100
200
300
400
500
600
$Q_s$, Hz
$P_s$, psi

551


CHARACTERISTIC Power Jet Imp.
TEST UNIT P/N 234004
AMP. R ATTRIBUTE
CURVE NO.
1
2
3
$P_s$~K pa
VAR.
$P_o$~K pa
$P_c$~K pa
0
Q cc/sec
T~°K
330
$N_{RA}$ —
MEDIUM OIL
LOAD NL
NO. OF LAMINATES 2
250
200
150
100
50
0
0
100
200
300
$P_s$, psi
$Q_s$, scfm
552